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LIEUT.-GENERAL SIR ARTHUR J. HERBERT, K.C.B., Quartermaster-General, in the Chair.

THE MUSKETRY TRAINING OF THE MILITIA.

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RECENT military events in Zululand, in the Transvaal, and in Egypt have brought into prominence the question how far the fire of our British infantry is practically effective in the field, and it can hardly be maintained that to that question public opinion is disposed to return an altogether favourable reply.

It is not for me, as a member of the Auxiliary Forces, to pass a judgment on the shooting powers of our Infantry of the Line, though I will briefly express my opinion that our musketry system, if imperfect in the sense of being limited and insufficient, was yet sound in principle, that it was on the whole faithfully and intelligently carried out in our battalions, that it at least laid the right foundation for good shooting, and that those who complained of its incompleteness, and contrasted it unfavourably with that of the German and other armies, hardly took into sufficient account the immensely different conditions of armies permanently stationed, like most continental ones, in home quarters, with no other occupation than to prepare for the next great European struggle, and an army which, like ours, is ever on the move, which is constantly, both at home and abroad, split up into detachments, often on police rather than military duty, and which at home is in great measure debarred by the closeness of the country and the density of the population from carrying out satisfactorily the more advanced branches of military shooting.

But our battalions of the Line do not represent the whole effective of British infantry; behind the Line stands the Militia, a force comprising,

besides 35 brigades of Garrison Artillery, and 3 corps of Engineers, 138 battalions of infantry, or only three fewer than the Line, exclusive of the brigade of Guards. And this is no paper force: it exists; it is called out annually for training; it is liable for permanent duty in case of war or great emergency; it has on every occasion, when our country has armed for war, shown its warlike spirit by voluntarily offering to extend its services beyond the legal limits of its engagements; and, further, something approaching to one-fourth of the pick and flower of its rank and file is enrolled in the Militia Reserve, and is liable, therefore, in time of need, to reinforce the ranks of the line.

I submit, therefore, that it is a question of no mean national importance how far the men composing these 138 battalions are capable of using with effect the weapons placed in their hands.

For the present we are, as regards musketry, in a transition state: for last year the Snider, with which we had hitherto been armed, was replaced by the Martini-Henry, a measure the value of which it would be impossible to overrate, both as ensuring unity of rifle drill, and a uniform and single description of ammunition for both Line and Militia, and as placing in the hands of the latter an arm which, from the flatness of its trajectory and its greater velocity, remedies to some extent two of the weakest points with imperfectly instructed men, namely, inaccurate judging of distance and sighting, and the failure to make adequate allowance for the action of wind on the bullet. At the same time the allowance of practice ammunition was doubled, the distances fired at were extended from 300 to 600 yards, and the course of musketry drill, both for drilled men and recruits, was considerably extended. And yet further changes have been quite recently recommended by the Committee on Musketry which sat in 1881 and 1882.

From various causes, however, we have hardly sufficient data to enable us to judge how far the new armament and the changes inaugurated last year have been successful. Owing to the late issue of the orders modifying the practice, a large portion of the force, 47 battalions, were exercised under the old system; of the remainder, many were prevented by want of adequate ranges from carrying out the new course; 3 battalions, owing to an ambiguity in the wording of the order, went through the drill and practice laid down for recruits, and only 31 battalions, or parts of battalions, carried out the new course in its integrity.

It will therefore, I think, be desirable to divide our subject into two parts, considering first the results of our Militia musketry system, as it existed up to last spring, and then applying the results of the experience so gained, together with that of the partial and fragmentary performances of last year, to the question of how far we may count on satisfactory results and progress in the future.

With this object I have examined and analyzed, as far as possible, the Returns of the decennial period from 1872 to 1881 inclusive; and, though it is difficult, owing to various causes, such as the non-training of the Irish battalions in some years, the attendance of various corps at autumn manœuvres in others, frequent changes in the positions and distances of firing, &c., to arrive at strictly accurate data, I have

yet got near enough the facts to force on my conviction the following points:—

1. That, very short and elementary as was the course of instruction laid down, yet every year a considerable number of battalions from one cause or another omitted it altogether.
2. That every year a varying proportion of other battalions failed to bring to the targets a minimum of 70 per cent. of their strength, exclusive of recruits.
3. That of the remainder a considerable number were only trained by half-battalions in alternate years.
4. That both in the battalions and half-battalions classified as having gone through the course the number of non-trained men was excessive.
5. That the target practice of those men who were exercised left much to be desired.

The following facts and figures will, I fear, conclusively establish the above points:—

1. Of the 148 battalions the maximum number ever trained in one year was 95 battalions and 20 half-battalions, in 1878. Only in three other years out of the ten has the number of battalions and half-battalions together exceeded 100. The maximum number of men ever trained in one year was only 43,162, in 1880.
2. Once only, in 1880, no battalions were excluded from classification, owing to the insufficient numbers trained, the numbers so disqualified in the remaining nine years varying from 15 in 1873 to 2 in 1881.
3. Since the option of training by half-battalions was first given, in 1873, the numbers of battalions availing themselves of it have varied from 13 to 29, exceeding 20 in seven out of the ten years.
4. In the battalions and half-battalions actually trained the proportion of non-exercised men has only once in the ten years fallen below 10, while thrice it has exceeded 20 per cent.
5. The maximum number of points obtainable for the twenty rounds which were fired, at distances never exceeding 300 yards, being 80, the figure of merit of the whole force has never in any year exceeded 31·11, while it has been as low as 24·40.

If we turn from the decennial period which I have been considering, and the shortcomings of which are brought above into pretty strong relief, to the results obtained under the new system in 1882, we shall hardly, I fear, find them much more encouraging: for the total number of corps exercised in that year, both under the old system and the new, amounted only to 62 battalions and 23 half-battalions, leaving 52 battalions and 23 half-battalions entirely untrained. Of these, 12 appear to have omitted the practice owing to want of ranges. The total number of men in the whole force, exclusive of recruits, who went to the targets was only 34,961, the number of non-exercised men in the battalions and half-battalions actually exercised exceeding 11

per cent. Of the success of the target practice itself it will be, perhaps, more convenient to speak at a later period.

I fear I have already stated more facts and figures than enough to prove that the Militia is still, to a great extent, entirely untrained in shooting, and that the performances of the men who actually go to the targets are, to say the least, indifferent.

Objections may perhaps be urged against what may appear to some rather a pessimist view of the subject: it may be argued, for instance, that the non-training of the Irish Militia, which accounts for the non-exercising of a considerable number of battalions in some years, is temporary and exceptional. I would reply that the training of the Irish portion of the force has been omitted for no less than seven years, since 1865, and that partly owing to those breaks in their instruction, and partly owing to the want of range accommodation in Ireland, the target practice of that portion of the force has been attended generally with very partial and moderate success, a fact which cannot be left out of consideration in an attempt to estimate the military value of the whole.

A more specious objection would be that the Militia is, after all, only an Auxiliary Force, and that it is vain and unfair to expect from it the same proficiency either in musketry or drill that is demanded from the regular army.

This is perfectly true, as far as it goes; but, granting this relative inferiority, it does not follow that it should be, as it unquestionably is, far greater in shooting than in drill. The noble and gallant author of "The Soldier's Pocket Book," published in 1869, says in his chapter on campaigning (page 143), "As for drill, the worst Militia regiment can do enough for all practical purposes." But the Militia has immensely improved in drill since 1869, and I think it may be fairly admitted that any tolerably good Militia battalion is, in respect of drill, at least within measurable distance of a battalion of the Line. Will any one venture to say as much with regard to their relative proficiency in shooting, though this is with some reason considered one of the weakest points in our regular infantry?

It would not, I think, be hard to establish that, of the two, it is somewhat more important that the Militiaman should be thoroughly trained beforehand in shooting than in drill, inasmuch as musketry is a business essentially requiring the most minute individual instruction, ample time, ample space, numerous teachers, and various appliances of all kinds. Supposing, for instance, the Militia embodied on a sudden emergency, every spare hour, from the moment of its assembly to the moment of its going into action, could be utilized more or less for drill; we know that in the Franco-German War, Prussian battalions and even brigades were sometimes sent to drill at the end of the day's march, and that during the siege of Paris, every spare day was utilized for drill by those troops not actually in presence of the enemy. But to improvise any useful process of musketry-instruction under similar circumstances would be obviously impossible; and it may fairly be taken for granted that the measure of efficiency in shooting possessed by a battalion on its mobilization would be practically the same as that with which it would go into action.

If then I have established the fact that shooting is the weakest point in the Militia, both positively and relatively to the Line, there rises the question whether this inferiority is an accident inseparable from the nature of the Militia service, or whether it is due to causes admitting more or less of remedy, and, to arrive at a just conclusion, it will be desirable to look back at the history of rifle practice in the force.

We have not very far to go, for it is an institution of comparatively recent date. During the old French war the Militia were, I believe, exclusively "red soldiers," and their musketry practice was simple. I read recently, in the old order books of my own regiment, a brigade order, dated at the end of last century, when the corps was encamped on the East Coast of Scotland, and a French invasion was considered imminent, directing each regiment to fire twenty rounds of ball, and recommending to Commanding Officers the purchase of old herring barrels to serve as targets.

On the reconstitution of the Militia prior to the Crimean War a certain number of battalions were, on no very apparent principles, converted into Rifles, but only nominally so, as they, as well as the "red" battalions, were exclusively armed with the smooth-bore percussion musket, and it was not until the spring of 1858 that the Enfield rifle was issued to the battalions embodied during the Indian Mutiny. These corps were about the same time ordered to send Officers and non-commissioned officers to qualify as instructors at Hythe, and those of their number which continued to be embodied during 1858, 1859, and 1860 went annually through the same course as the Infantry of the Line, with results by no means unsatisfactory, as, although composed of young soldiers with no previous practice, and in competition with the Line, which had had the advantage of some previous acquaintance with the Minie and the Enfield rifle, several battalions took a fair place in the Annual Returns—one, in 1858, standing above fifty battalions and depôts of the Line. In one important respect this experiment was of substantial value, because it proved that the Militia could, after a comparatively short period of embodiment, provide sufficient and competent instructors from its own ranks, without drawing on the Line. Having myself been a Musketry Instructor at that time, and having put a battalion through the annual course, I can testify that some of the smartest and most successful musketry drills I had, were young lance-serjeants and corporals, whose service had been limited to the Militia. Some of these, on the disembodiment of their regiments, were placed on, and became valuable members of, the Permanent Staffs.

With the close of the Indian Mutiny, and the consequent disembodiment, came a very critical time for the Militia, and specially for its musketry. Retrenchment seemed urgent after the vast war expenditure of previous years; the enthusiasm which heralded the foundation of the Volunteer Force threw into shade the old constitutional army, the entire suppression of which was advocated both in Parliament and in the Press, not only by extreme politicians, to whom it was odious, both as a military body, swelling the Estimates, and as a force largely controlled and commanded by the territorial aristocracy,

but also by a class of theoretical military reformers, with whom ideal systems, based on foreign models, outweighed in value a force which, if, like so many of our institutions, anomalous in principle, has yet proved itself eminently national and valuable in practice. It has ever been to me a convincing proof of the value and practical character of the Militia, that it survived those years of grievous discouragement. But, though it did survive, it was very far from being unscathed. The length of the trainings was reduced in 1859 to twenty-one days, and, though raised to twenty-eight in the following year, it was again lowered to twenty-one in 1861, and remained at that figure till 1864. So unattractive at that time was the service that it was impossible to keep up the establishment of Officers: the rank of Ensign was abolished, or rather abolished itself; many battalions found it impossible to keep up the number of Captains; and an order had to be issued that, in the absence of sufficient Officers to command the companies, the colours need not be taken on parade. The force further suffered from the fact that not a few of the experienced Instructors of Musketry, who had learnt their work during embodiment, were tempted to leave the Militia by the offer of Adjutancies in the Volunteers, and in 1861 there were only nineteen qualified Officer Instructors remaining in the entire force. But what above all made any useful musketry instruction impossible at that time, and for many years after, was at first the entire absence, and subsequently the miserably inadequate extent, of the preliminary drill; for of this I am quite sure, that, however much we may differ on other points, there is no Militia Officer in this room but will agree with me that, to be of any use at all, our musketry system must have its foundation laid on the sound and thorough instruction of the recruit. But nothing of the kind was possible from 1859 to 1873: for the first two years of that period there was no preliminary drill whatever, while from 1861 to 1873 it varied in the most casual manner from seven days to twenty-eight, having twice been at the lowest figure of 7, seven times at 14, once at 21, and twice at 28 days.

I think I may say of the whole period from 1859 to 1873, and indeed of several subsequent years to a considerable extent, that, although battalions were annually ordered to go through a limited course of musketry, that branch of instruction occupied very much the same place in our Militia system that the study of modern languages did in our public schools some thirty years ago: on paper it formed part of the studies professedly taught, and, if any one chose to devote to it time that could very ill be spared from more remunerative work, he was welcome to do so. But practically it was more or less ignored: no credit whatever attached to its performance, no penalties whatever attended its neglect or its entire omission. I can recall a case in which, after a battalion had carried out the prescribed course with great zeal during a training limited to twenty-one days, sacrificing to it at least two-thirds of the scanty time available, it was inspected by an Officer holding an important Staff appointment, who totally ignored the existence of musketry throughout the whole proceedings, and when invited in the orderly-room to examine the registers

and Returns, declined to do so, giving as his reason that he knew nothing about musketry, and that he did not believe that any one else who had not been at Hythe, did. Undeterred by this, the battalion repeated the course in the following year, and this time was inspected by a veteran holding the appointment of Inspecting Field Officer, who likewise treated musketry as non-existent, excusing himself on the ground that he had never had anything to do with troops armed with rifles. I make no doubt that some of the Officers I see before me, can recall similar experiences.

Can it be matter for surprise that, up to 1873, the shooting of the Militia, conducted under such discouraging conditions, was miserably inefficient, and that Commanding Officers and Adjutants and serjeant-majors, despairing of producing satisfactory results, or of getting much credit for them if attained, and knowing well that the efficiency of their battalions would be judged very much more by marching past than by musketry, too often grudged every hour seemingly wasted on the latter, and gladly availed themselves of every plausible excuse for avoiding or curtailing it?

With 1873, however, there came at least the dawn and promise of better things, for in that year the preliminary drill was extended, for all battalions which were willing to avail themselves of this great advantage (and they were, I believe, the great majority), to fifty-six days, and for the first time it became possible to attempt some sound and systematic grounding of the recruits in the use of their weapons. But the mischief resulting from past years of neglect clogged and hampered progress, as indeed it still does to some extent, at every turn: the dislike and neglect of musketry among those responsible for the instruction of the Militia long survived such circumstances and conditions as those to which allusion has been made above, and which to a certain extent justified them. If any one will glance at the answers given by Commanding Officers to the queries addressed to them by the Royal Commission of 1876, he will find that no inconsiderable number of them roundly condemn the course of instruction then existing, and which continued with but little change till last year, as an utterly useless waste of time, while many others gave it only the most cold and qualified approval. Moreover the rank and file, and specially the non-commissioned officers not on the Staff, were, from the lack of previous thorough training, almost more difficult to deal with successfully than mere recruits; for they had become confirmed, by long habit, in faults which it was almost impossible to eradicate, and the ranks were long cumbered with these survivals of scamped instruction and desultory practice. Even to this day most of us are familiar with the shambling figure of the old re-engaged man, who has supplemented or supplanted his insufficient position drill on principles of his own, who faces the target in an attitude borrowed apparently from the bayonet exercise, who after an endlessly long and wavering attempt at aim spasmodically twitches the trigger with the tip of his finger, and accepts the jeers of his comrades at having ploughed a furrow in the turf 30 yards from the muzzle, or sent his bullet wandering in celestial space, with the callous stolidity bred of habitual failure.

In 1880 an experiment was made in the direction of giving a comparatively thorough course of training to a certain number of battalions, the idea being that corps thus instructed at certain intervals might altogether omit musketry in other years, and devote all available time to other drill. The fifteen battalions selected were made fairly representative, being drawn from England, Scotland, and Ireland. But the results were disappointing: the shooting was either moderate or indifferent; the system was generally, I believe, most unpopular with the Officers and men subjected to it, the general opinion being that whatever little gain was made in the shooting was more than counterbalanced by the falling off in drill and discipline; and it is, I imagine, safe to say that the experiment will not be repeated—a result not to be regretted, as it is contrary to all experience that men can be so thoroughly taught how to shoot as not to fall off in accuracy, if absolutely deprived of all practice for several years.

On the failure of this experiment, matters in 1881 practically reverted to the old groove so often traversed.

Under such unfavourable conditions progress could but be slow and gradual, yet progress there was: the numbers of only partially trained battalions visibly though slowly decreased between 1873 and 1881, and, though it is impossible, owing to changes made from time to time in the mode and distances at which the firing was conducted, to the accidents of weather, and other causes, to institute strictly accurate comparisons between the various years comprised in that period, there is a general and marked tendency towards improved shooting indicated in the Annual Returns.

I believe that that improvement would have been far more general and more rapid, but for two drawbacks, which I did not include among those with which we had to contend in the past, because unfortunately they belong not more to the past than to the present: they are most grave ones, and, until they have been effectually dealt with, must continue to be stumbling-blocks in the way of all real progress.

There is, in the first place, a most serious, and unfortunately an increasing, deficiency of properly qualified instructors. I am aware that the appointment of both Officer and sergeant Instructors has been recently discontinued in the Line, and that the training of the companies is entrusted for the future entirely to the company Officers. The Line may possibly be ripe for such an experiment, for during more than a quarter of a century they have been steadily preparing for it: during that period each battalion has always had one, generally two, subalterns who had qualified at Hythe, and consequently they now comprise in their higher ranks a very considerable proportion of Officers who have had practical experience in musketry instruction. In the Militia, unfortunately, this valuable leaven is almost entirely wanting; for, although for over twenty years it has been the rule on paper that each battalion should have a qualified instructor, a subaltern if possible, practice has in this matter lagged very far behind precept: little or no pains seems to have been taken to see the rule carried out, and, as a consequence, many battalions have, I believe, never had an instructor at all, the greatest number appearing in the Army List for any one year being 92 in 1873, and even this modest proportion

has fallen to 51 in 1883, so that at present we have 87 battalions out of 138 unprovided. And even this does not show the full measure of our shortcomings, for, although the order is that these appointments should be held by subalterns, if available, only 17 subaltern instructors appear in the Army List of last February, the remainder being Captains, who have held the post, some of them for many years, presumably because there were no subalterns willing and able to replace them. Those battalions which have been without instructors are of course pretty fully represented among those which in past years have omitted the annual course altogether. Others have endeavoured to make up the deficiency during training by borrowing Officers from the Line, a makeshift, precarious at all times, certain to be found wanting at any time of real emergency, and further involving the humiliating admission that we are unable to provide adequately for the instruction of our own men—a conclusion which, with some experience both of musketry and Militia, I feel bound emphatically to deny. It is impossible to doubt that in the past this want of qualified Officer Instructors has very largely contributed to the unsatisfactory results already indicated, and that the Militia has suffered much already, and must do so largely in the future, from the almost entire absence among the senior Officers of men who have had the advantage of a Hythe training. One instance has indeed come under my notice, where a battalion, by steadily adhering to the regulation of having a subaltern Instructor, now numbers six Officers, besides the Adjutant, holding Hythe certificates; but this is just one of those exceptions that prove the rule.

The deficiency in instructing power has, unfortunately, not been limited to Officers : one of the chief difficulties has always been the small number of really competent non-commissioned officers available for drill, and the large numbers consequently composing the squads, which, though ordered to consist of not more than ten men, could rarely be reduced much below double that number. The non-commissioned officers not on the staff, being little, if at all, better instructed in musketry than the rank and file, have generally been able to render but little assistance hitherto, and two staff-sergeants per company, supposing the staff to be complete, were woefully insufficient to give to sixty or eighty men, within the compass of a few days, or rather hours, the minute and detailed instruction which they required.

A second, and, if possible, a still more serious drawback than the want of instructing power, has been, and unfortunately still is, the entirely insufficient amount of range accommodation. A glance at the Annual Musketry Returns will show that every year a certain number of battalions, sometimes as many as thirty, are returned as having omitted target practice owing to want of ranges, and we may also, I think, safely conclude that a considerable proportion of those battalions reported to have omitted the course with "no reason assigned" have done so for the same reason. But, in addition to the battalions entirely debarred from target practice by this cause, there is a yet larger number which are most seriously impeded and inconvenienced both by the distance of the ranges from their headquarters and by the

inadequate number of targets, markers' butts, and other necessary appliances. And, though this evil has year by year very largely checked the proper training of the force, and caused the utmost inconvenience and discomfort to many corps, it has as yet been but little abated. The Annual Returns only give us the number of battalions entirely untrained owing to this course; but I have before me, thanks to the kindness of Major-General Cameron, C.B., commanding the Northern District, a circular memorandum giving the results of the practice carried out by the Militia under his command, from which I find that no less than fourteen out of forty-four battalions were either not instructed at all, or were only partially so, from want or insufficiency of ranges, and I have no reason to believe that the shortcoming has been less in other districts. There being very few Government ranges available, it has been necessary in a great many instances to hire those belonging to the Volunteers, and these, unfortunately, besides being often situated at most inconvenient distances, are in a great majority of cases unprovided with a number of targets in any way sufficient for putting 500 or 600 men through a course of practice in a space of time limited practically to about fourteen days.

Major Salmond, D.A.A.G. for Musketry in the North British District, in an official memorandum, dated this year, puts the case, as regards the Militia under his supervision, in the following terms:—"It is an utter impossibility for more than 400 men to get through that quantity (*i.e.*, forty rounds), and up to the full extent of 600 yards, on a range having only two targets (*i.e.*, a two-section range), *which is all that is available in the majority of cases.*" And I feel sure that many in this room will agree with me that nothing has done so much to make musketry unpopular—as in too many cases it unfortunately is, both with Officers and men—as the necessity for parading men at unseasonable hours, and detaining them on the ground for long and weary periods, too often in inclement weather, owing to deficient range accommodation. I have myself seen companies paraded at 3.15 A.M., in order to make use of a tidal range, and cases of similar inconvenience are only too common; some companies have a railway journey of 12 miles or more intervening between them and their targets.

I have, I believe, stated enough to prove that, if our progress in musketry has in the past been slow and halting, that result has been due to the fact that it has never really had a fair chance. It has always been treated as an extra, rather than as a matter of extreme importance; it is only within a very recent period that the extension of the preliminary drill admitted of any attempt to impart some solid system of instruction to our recruits, and we have had all along to carry out in an extremely limited time what ought to be a most minute course of individual training with a wholly inadequate amount of instructing power. Add to these drawbacks the absence and the inadequacy of ranges, and it will be seen that throughout we have been contending with immense difficulties, and that, if the results have been disappointing, this has been due rather to the very limited opportunities afforded to us than to any inherent weakness in the Militia system.

Let us now inquire how far the changes inaugurated last year are calculated to effect the improvement urgently required. Of the great and substantial advance made by the substitution of the Martini-Henry for the Snider rifle I have already spoken; and the changes in the drill and practice, both of recruits and trained soldiers, by the Army Circular 129 of 1882, are of at least equal value. The largely increased amount of musketry drill now exacted from the recruit must in the course of a few years fill our ranks with a class of men infinitely better trained than those we have now, though these latter are undeniably superior to those of ten years ago. Nor can I consider the time devoted to it, amounting on paper to fifteen and a half hours, but really occupying in practice something near a half more, if the work be thoroughly done, as at all excessive, or as interfering unduly with the other branches of instruction. I am of course well aware that under the new system adopted last year, of drilling our recruits immediately on enrolment, their adequate instruction in musketry has been attended with the greatest difficulty, and that the percentage of non-trained and only partially trained men, in battalions working under the new system, contrasts most unfavourably with that of those battalions which, owing to their being detached from the regimental headquarters, still drill all their recruits together, although by a very strange anomaly these latter, working on the old and condemned system, are allowed only fifty-six days to do the same work for which sixty-three days are allowed under the new. I cannot but hope, in the best interests of musketry, that we may yet retrace our steps in this matter, and revert to the old plan of drilling our recruits in one body, carrying them straight on from the preliminary drill to the training.

At present, owing to the men coming in by twos and threes, as enlisted, it is always difficult, sometimes impossible, to arrange them properly in squads for musketry instruction, and further, the dead months of winter, when civil employment is most scarce, being naturally the briskest time for recruiting, a large proportion of those who join have to go through their preliminary drill at a season of the year when it can only be conducted at the greatest disadvantage. The shortness of the winter day greatly limits the hours available for drill, and too frequently the inclemency of the weather either still further curtails them or makes them periods of discomfort, and almost misery, to the men. Position drill in February or March is too often the reverse of a genial occupation, though even that yields in cheerlessness to hanging about for hours at the same season on a wind-swept range.

But, however this question may be settled, I maintain that we ought to be able in sixty-three days to spare for musketry the proportion of time set apart for it by the circular of 1882, and that with very strict economy of time it may be just possible for those battalions which are, as I think, unfairly handicapped by being limited to fifty-six days, to compress the work into that period; and I confidently look forward to good results from this change, if faithfully and zealously carried out.

I will now pass on to consider the course of instruction laid down for the drilled men of the battalions in Table B of the same circular.

Among the answers, already referred to, given in by Commanding Officers to the queries of the Royal Commission of 1876, there are not a few which treat the possibility of carrying out any useful course of musketry within a period of twenty-seven days as entirely out of the question, and which suggest a prolongation of the training as the only solution of the difficulty; and if Officers, whose zeal and experience entitled their opinions to the greatest weight, entertained those objections to the course, as it existed in 1876, and which only exacted two hours' drill a day for four days, and two days of three hours each for practice, I fear they must entertain yet stronger objections to Table B.

But, while respecting their convictions, I must frankly say that I cannot agree with them. I concede at once that it is impossible in twenty-seven days to teach 600 or 700 men how to shoot. But that is the business, not of the training, but of the preliminary drill, and I am convinced by experience that, if the men have been fairly well grounded as recruits, it is quite possible, even within the very limited time available, not only to maintain the amount of knowledge and familiarity with their weapons already acquired, but year by year to improve upon it. Were it not so, I should feel disposed to regard the whole question with despair, for I look on the suggestion of prolonging the training in order to allow more time for musketry not only as hopeless of adoption from a financial point of view, but as one which, if adopted, would do the Militia more harm than good. You can, of course, do more work in forty-two or in fifty-six days than you can in twenty-seven, *provided always that you have the men to do it with;* but, so far as my experience goes, the present period is quite long enough for the men in general, and specially for those who are the most valuable element of the whole, those, namely, who are not the mere drifting waifs and strays of the population, but who by their steadiness and industry are able to command well-paid employment in civil life. This is a stratum of society which cannot be too largely drawn upon by the Militia. It furnishes a large proportion of the non-commissioned officers not on the Staff, and of that most valuable class, the re-engaged men. To many of these it is a considerable sacrifice of wages to turn out even for twenty-seven days: that they do so in such considerable numbers is, I think, one of the most satisfactory proofs of the popularity of the Militia, and of the strong *esprit de corps* existing in the battalions.

But I am convinced that to add a fortnight, or even a week, to the present period would drive many, and those the best, of this class out of the service, and that, in default of them, we should be driven more and more to compete with the Line for the "loafer" class, already much too numerously represented in both. Were confirmation required for what I have advanced on this point, I believe that it could be supplied by those Commanding Officers who had their training prolonged last year to fifty-six days, owing to the exigencies of the Egyptian War: though the men accepted the extension as a matter of duty, it was the reverse of popular, I believe, with the great majority of them. It was attended in many cases, I know, with considerable want and suffering

among their wives and families, and great difficulty was found by some of the men in resuming civil employment after so long an interval. It must be remembered that a large proportion of our rank and file is drawn from our large factories, the managers of which do not always view with a very favourable eye the enlisting of their hands, even for the present limited training; were it extended, I fear the notice, "No Militiaman need apply," would come into universal use, and we should thus dry up, by a stroke of the pen, one of our best recruiting grounds.

There is really no choice for us but to make the most of such time as we have, and, so far as the musketry drill laid down in Table B is concerned, I am not prepared to make more objection to the time required by it than in the case of Table A for recruits; considering the vital importance of the subject, it does not appear to me to be excessive, in proportion to the time still remaining at our disposal for other duties, while it is sufficient to do much towards confirming and improving what the men should have already been more thoroughly taught as recruits. I may here mention, though only to condemn it, a suggestion that has once or twice been made, that the recruits should be thoroughly trained in musketry once for all, and that the trainings should be exclusively devoted to other drill. I hold this to be utterly impracticable; we can indeed lay the foundations of good musketry in our recruits, and it should be our business to lay them sure and deep, but, to be of any good, they must be built upon in after years. The young lads who form the bulk of our recruits are incapable, physically as well as from the nervousness inseparable from the first essays at burning powder, of being made, as a rule, really good shots; in spite of their more extended period of instruction, and of the advantage they possess in always being drilled in comparatively small squads, their performances at the targets, so far as my experience goes, have always fallen very far short of those of the drilled men, although these latter still include among their numbers many men whose instruction as recruits had been either superficial or entirely neglected. The best shots soon fall off, without at least occasional practice, and it will hardly be alleged that the practice provided for the drilled men errs on the side of being excessive.

While approving, however, of the arrangements for musketry *drill* made in Table B, I cannot but think that, as regards practice, too much has been attempted, not in the number of rounds, but in the distances at which they have to be fired. I have already remarked that the results produced last year under the new system were too fragmentary to admit of our drawing thoroughly trustworthy conclusions from them, and the difficulty is enhanced by the fact that, owing to the existing system of centralization (if that can fairly be called centralization which consists in referring everything connected with musketry to a sea-side village in Kent), the results of that year's practice had not been in our hands till after the date at which it was necessary to place this lecture in the hands of the printer. Thanks, however, to the kindness and courtesy of the Inspector-General of Musketry, I was furnished early in last month with the figures recording the performances of the various battalions exercised, and in those

figures I find strong confirmation of my opinion that we have attempted too much.

Of the thirty-one battalions, or parts of battalions, exercised under the new system, one half-battalion only made a figure of merit exceeding fifty, while the figure of seventeen battalions was under forty. I cannot, I believe, better explain the significancy of these figures than by quoting again from the memorandum of the Deputy-Assistant Adjutant-General for Musketry for the Northern District. He says, with reference to the results of the practice in his district, "The trained Militia soldier has now to fire at the same distances as the Line recruit, viz., from 100 to 600 yards; the only difference is, the former expends half the number of rounds at each distance. If, therefore, we halve the results of the shooting of Line recruits, we shall have a standard by which to judge. Taking bad with good, I should say that the figure of merit (including volleys) of Line recruits is at least 112 points per man. It is very seldom, indeed, that the figure of any party is below 100, a good many regiments and depôts show between 120 and 130, and a few between 140 and 150. Taking the average as 112, and halving it, we have our standard figure of merit, viz., 56. But not one single battalion comes near this, although the men who fired were not Militia *recruits*, but men who had all had previous musketry training. The best figure is 47·94; the worst 28·66." And Major-General Cameron, C.B., commanding the same district, records his opinion on the same subject in the following terms:—"Making every allowance, the shooting is very very far from what it should be, and every effort must be made to reach a higher standard. . . . The Major-General is convinced, from what he has himself observed (the men are unable to stand up properly to their rifles when firing), that much more position drill is required for both recruits and trained soldiers."

It is, I venture to think, impossible to study the above facts and figures without coming to the conclusion that a great deal of the ammunition expended in order to produce these deplorable results was worse than wasted, that we have attempted too much in pushing our men on at once from 300 yards, which had been the maximum for many years, up to 600 yards, and that we should have made more real progress if, so long as our ranks comprise, as they do now, a large proportion of imperfectly trained men, we had contented ourselves with the course of *practice* laid down for recruits in Table A. I am very far from disparaging the value of long-range fire: it will always be valuable, for some operations of war it is essential; but battles are not won by it, and in every action there will be critical times and places where infantry who can fire with calm and accuracy within comparatively short range will make their mark. It should suffice us for the present to endeavour to work up to this standard, which, modest as it is, is yet still far above us; and, when the mass of our men are able to shoot steadily and quickly up to 400 yards, it will be time enough, and will then be a comparatively easy task, to carry them on further, or, what would in my humble opinion be the preferable course, to select those whose good shooting and general intelligence

gave good promise of further improvement, and to train them specially for the duties of marksmen, continuing to improve the remainder as far as possible in the delivery of that steady, accurate fire, at comparatively close range, which after all must be the main function of the mass of our infantry in action.

But, after all, the question of the distances at which the forty rounds should be expended is one of detail, though by no means an unimportant one, while, taken as a whole, the circular of 1882 marks a distinct stage of progress, from which valuable results may justly be expected. Unless, however, it be supplemented by other reforms, the progress made will, I fear, be slow and halting.

The first step should, I think, be to place the superintendence of the musketry, as well as of all other branches of instruction, wholly in the hands of the Generals Commanding districts, and, under them, of the Officers Commanding regimental districts. The present system of referring the battalion Returns to the Inspector-General of Musketry naturally predisposes the former Officers to leave mainly to him what appears to be his speciality, and rather to limit their own attention to the other details of instruction. But, unlike them, the Inspector-General, having no personal knowledge of the various corps, has no means of judging how far their practice may have been affected by bad weather, bad or insufficient ranges, or other causes, and how far the Returns can be accepted as representing fairly their shooting capabilities, while he can only after an interval little short of a year, and then in a comparatively circuitous manner, bring any pressure to bear to check such irregularities as do come under his notice.

To the urgent necessity for additional range accommodation I have already called attention, and I need only add that the present system of hiring ranges from the Volunteers is in very many cases not only insufficient, but costly. The Volunteers, having very heavy expenses of their own, can hardly be blamed if they make the most of the practical monopoly they enjoy; but I cannot but think that if the sums now annually paid for very insufficient accommodation were capitalized, very much might be done towards permanently providing really good ranges for both the Line and the Militia.

Whether the appointment of Instructor of Musketry be abolished or not in the Militia, as in the Line, it appears to me more essential than ever, if company Officers are to be made responsible for the shooting of their men, that some opportunities, beyond what can be afforded them during the annual trainings, should be given them of learning themselves what they have to teach. Whether this should be done by establishing a short course, say of one month, at Hythe for Militia Officers, or by temporarily establishing classes for the same period at the headquarters of districts, or by assembling the Officers of each battalion at their own headquarters before the training, is a matter of detail. But, unless something of the kind be done, disappointment must result: the Officers, despairing of teaching what they do not know themselves, will practically abandon the business to the over-worked staff-serjeants, and the system of Officers instructing their own companies must be a sham, and nothing else. I wish, rather than hope,

that this matter may not be overlooked, for while of late years very much has been done to promote the efficiency of the Militia privates, comparatively little has been done for the Officers who have to command them, and, while it is still too easy for the idle and indifferent to get on with a minimum of professional knowledge, it is still too difficult for those who are fond and proud of their work to find opportunities for making themselves masters of it.

Something more might also, I think, be done in supplementing our want of competent non-commissioned instructors by loans from the Line. Those fair hopes which were held out to us when the brigade depôt system was first established, of each battalion being able to borrow non-commissioned officers for the training from its own depôt, have, I fear, generally proved delusive; in my experience I have only once, in ten years, been able to borrow three, who proved so useless that I sent them back at the end of three days. But the necessity for such help is so pressing that I think that the question should be taken up systematically, and that in every district lists should be prepared of non-commissioned officers or men, belonging either to depôts or battalions of the Line, capable of drilling in musketry, or familiar with marking, and that these, so far as they might be available, should be told off to assist in the drill of the several Militia battalions.

It seems possible, also, that some assistance might be obtained from non-commissioned officers belonging to the Army Reserve, some of whom would probably be found willing, on receiving the pay of their rank, to be attached for this purpose for three weeks or a month to the Militia battalion nearest their place of residence.

I cannot profess to regret the proposed abolition of the regimental "figure of merit," as, owing to the various conditions under which different battalions shoot, and the varying degree of strictness with which the practices are carried out, and their results are recorded, the "figure of merit" failed in a great measure to provide a really trustworthy estimate of the shooting powers of the different corps, while it held out a premium for irregularities which have not been wholly unknown in the Line, and which can hardly be supposed to be non-existent in a force so little subject to supervision in its practice as the Militia. Still it seems desirable that, in some form or other, a healthy spirit of rivalry in shooting between the various corps should be kept up, and I do not think this could be better done than by the Government adopting and making its own the machinery and organization of the Army Inter-Regimental Rifle Matches, an organization which has done a great deal to promote a healthy interest in shooting in the Line, and which has most generously included the Militia in its operations, although as yet, I am sorry to say, we have not availed ourselves as fully as we might have done of its advantages.

It seems further to be a question whether, now that the "figure of merit" has been discontinued, some discretion might not be permitted as to not sending to the targets men who have proved themselves at drill incapable of doing any good there, and also of stopping the practice of men who have broken down on trial: men of both these categories would probably be far better employed in going through a

renewed course of drill, and in firing blank at empty cartridge cases,[1] than in wasting time and ammunition on the ranges.

The plan of training by half-battalions seems to require modification: in theory it may appear to have the advantage of allowing all the instructing power to be concentrated on a comparatively small number of men; but in practice, so far as can be judged from the Annual Returns, the half-battalions show no superiority whatever over those corps which train all their companies. Moreover a plan having for its result that the soldier, during his five years' engagement, may only twice, and can only be thrice practised in musketry, seems self-condemned. In the case of battalions of ten companies, and of others which suffer from limited range accommodation, it may be impossible to train the whole, but in a great many cases this difficulty can hardly exist, judging from the very small numbers trained in many of the half-battalions, twelve of which last year each exercised less than 250 men. It would seem a much preferable arrangement for each battalion to carry out the course to the best of its ability every year, reporting the number of companies not exercised, and the reasons for the omission, to the General Officer Commanding the district, who would be in a position to judge how far the omission was due to unavoidable circumstances.

Authority should, I think, be given to such Commanding Officers as might desire it, to draw a certain proportion of ammunition, not exceeding five rounds per man, for private practice and match shooting, its consumption being accounted for in the Annual Returns.

While it may be impossible to devote more time than at present to the shooting of the rank and file generally, some of the old and thoroughly drilled men might occasionally with advantage spend an afternoon at the targets, instead of at the usual drills, and such an indulgence would be looked on as a privilege, and would do something to raise the general standard of the shooting.

I would further recommend the issue of three or four sets of the "Morris" attachment (rifled tube) to all battalions able to provide suitable ranges. I have two in use in my own battalion, and consider them valuable, as enabling recruits to become familiar with the handling and sighting of their weapons in practical use; and, as an amusement, tending to keep men in camp, and out of the public-house, they have a value, quite independently of musketry.

Some such changes as the above should, I think, be made in order to give full effect to the new system inaugurated last year. But it is not our duty to sit still with our hands folded, awaiting the arrival of such reforms as we may think desirable. We have it in our own power, independently of all extraneous aid, to do very much towards levelling up the shooting of the Militia, if we really recognize its importance. It is not so much a question of how much, or how little, time we devote to it, as of the use we make of the time. If it be grudgingly given, if Commanding Officers and Adjutants count every moment lost that is not spent on their parades, if company Officers vote musketry drill a bore, and leave the drudgery of it to their staff-

[1] Firing blank at an empty cartridge case, placed on a wall or rail at a few paces' distance, is a good test of accuracy of aim and steadiness in pressing the trigger.

serjeants, the men are imitative enough to vote it a bore also, and the poor results at the targets, due to scamped and careless drill, will confirm them in the belief that the whole thing is a mistake, and a waste of time.

If, on the other hand, it be recognized that all other drill is a means to an end, that end being to bring the soldier into the position in which he can use his weapon to the best effect,—if the Commanding Officer is constantly present both at the ranges, and, what perhaps is even more useful, at the musketry drill,—if the company Officers take a keen and personal interest in getting their men into good position, and watch and coach them carefully and kindly at the targets, their influence will rapidly spread in the ranks, and in the pride and emulation between man and man, and company and company, will be found the leverage and motive power that is required.

I have hitherto abstained from touching on those recommendations of the War Office Committee on Musketry, presided over by Sir D. Lysons, which refer to the Militia, because they are as yet merely suggestions. Yet even as suggestions they demand our consideration. That it is desirable that the Militia recruit should receive the same amount of musketry training as the Line recruit is in theory unquestionable; that the shooting of the Militia soldier would be materially improved by his annually firing sixty rounds, instead of forty, as at present, is equally undeniable. But when we come to consider these suggestions practically, we are at once confronted by the difficulty of want of time. Whatever may be the shortcomings of the Militia, no one will, I think, venture to say that we do not pretty exhaustively utilize the time placed at our disposal. Every hour is appropriated, and we cannot possibly devote to musketry more time than we do at present, save by sacrificing some other kind of work. And I cannot but feel that, when it comes to be a question of what is and what is not essential, of what must at all costs be done, and what may be left undone, it might be well, by dispensing with some of the more ornamental portions of the field exercise, to reduce somewhat the great amount and variety of drill that we are expected to master, and so to spare a few more hours for perfecting our men in the use of their rifles. At present we have to master two entirely distinct tactical systems—the one that of the old two deep line, which holds so glorious a place in the history of British infantry; the other that which, in some form or other, has been forced on every European army by the introduction of breech-loading arms of precision, and which with us is represented by "the attack formation." The old two deep line was the "attack formation" of Maida, of the Peninsula, and of Waterloo; it has been of necessity replaced by a more modern formation; yet, if any one examines Part III of the Field Exercise, he will find that about one-half of what is called battalion drill consists of varieties and combinations of the two deep line, and further that one considerable section is devoted to a variety of formations for receiving cavalry, though all modern experience teaches that the only practical formation for the latter purpose is to develop the largest possible front of fire, and to shoot as hard and fast as possible, so long as the cavalry are misguided enough to remain within range.

I am quite prepared to admit that the practice of these movements may have its value in making troops handy, *if there is time to teach them.* But, when it is merely a choice of what must be sacrificed, it might perhaps be as well at least to postpone the study of this class of manœuvres until the mass of our rank and file are somewhat less miserably incapable of shooting straight than they are at present.

I trust no one will so far misunderstand me as to suppose that I seek to disparage drill generally in favour of musketry: it is, I believe, impossible to be too strict in exacting the most faultless finish and precision in all movements performed; but there is all the difference in the world between good drill and complicated and unnecessary drill. To put the point practically, if, of two battalions, both equally able to move handily in any direction in quarter-column and in fours, and to work with intelligence and precision through all the phases and varieties of the attack formation, the one be able to shoot, and the other, *not* being able to shoot, can change front at less than a right angle on a central company, can retire in column of double companies and form line to a flank, can form a two deep square from line at the double, or perform faultlessly any other of the stately movements which go by the name of battalion drill, it seems to me that the first might prove a useful fighting unit, while the latter would be as sheep for the shambles in the day of battle.

It is of course our duty to do simply what we are told, and we shall continue to teach, if required, the same amount of manœuvres as heretofore; but we cannot make bricks without straw, we cannot make more than seven days in the week, or twenty-four hours in the day, and I must confess that for myself I can see no other plan than that which I have suggested that can render it possible for us largely to add to the time now devoted to musketry.

I may perhaps be asked what results I expect from the changes and reforms which I have advocated, supposing them to be carried out,—whether I believe it possible ultimately to make of the mass of our men finished marksmen, capable of shooting accurately at long range, and of meeting on equal terms such men as the Boers of South Africa. I answer emphatically, *No*, no more than I should expect, by training a party of city clerks to shoot at glass balls on Saturday afternoons, to make them fit to compete in shooting at driven grouse with the men who expend their thousands of cartridges at them every season. My ambition is a much humbler, but, I believe, a more practical one. I believe it to be quite possible, by honest effort on our own part, aided by assistance and encouragement from the authorities, to raise the general shooting of the Militia above the dead low level at which it unfortunately stands at present, and to make our men at least as formidable with their weapons—I will not say as the half-drilled Egyptian rabble, who yet made us pay dear for our victory in the twenty minutes' scramble of Tel-el-Kebir—but as the men who once and again hurled back the Russian and Roumanian columns, crushed and bleeding, from the entrenchments of Plevna, or those who lined the heights of Gravelotte, and choked the valley beneath them with the wreck and havoc of the Prussian Guard.

TABLE, *giving results of Militia Musketry Practice from* 1872 *to* 1881 *inclusive.*

Years.	Battalions exercised.	Total numbers of men minus recruits.	Total numbers of men exercised, minus recruits.	Numbers not exercised.	Percentage not exercised.	Rounds per man.	Ranges. (Yards.)	Battalion classification. Very good.	Good.	Moderate.	Bad.	Total figure of merit.	Remarks.
1872	79	45,311	34,556	10,755	23·73	20	150 200 standing 250 300 kneeling	34	31	13	1	29·24	6 battalions engaged at autumn manœuvres.
1873	94	37,461	32,080	5,381	14·36	20	„ „	33	32	20	9	28·28	10 do. do.
1874	89	39,792	33,273	6,519	16·36	20	„ „	38	32	12	7	29·43	
1875	103	42,478	36,308	6,170	14·52	20	„ „	34	39	24	6	28·39	
1876	91	40,836	34,918	5,918	14·48	20	200 standing 300 kneeling	10	33	29	19	24·92	7 battalions mobilized.
1877	104	47,786	40,674	7,112	14·88	20	„ „	12	27	40	15	24·51	
1878	115	39,496	36,054	3,442	8·71	20	„ „	34	39	24	6	24·40	
1879	38	23,901	17,149	6,752	28·24	20	„ „	7	11	18	2	25·78	Musketry made optional, owing to training being reduced to 20 days.
1880	105*	49,134	43,162	5,972	12·15	20	„ „	11	33	35	11	25·78	* Including 15 battalions specially exercised.
1881	93	43,383	34,352	9,031	20·81	20	150 200 250 300 standing kneeling kneeling lying	48	37	6	0	31·11	Irish Militia not trained.

Colonel G. P. Evelyn (Commanding 3rd Battalion East Surrey Regiment): In the remarks that I am about to make I shall differ in some respects from the lecturer, although on a great many points I perfectly agree with him. It is not that I am apt to take a slight view of the musketry training of the Militia, for I think it is very well proved, by the figure of merit of my own battalion this year, which has headed the list, that we pay a great deal of attention to our shooting. Looking, however, at the limited period allowed us for training, I fear that there is a mistake in increasing the number of rounds. Twenty rounds are as many as we can manage, and I do not consider that any advantage would be gained by increasing them to forty; we have to fire in all weathers, and if there be bad weather it becomes a perfect nuisance to the men, and I am afraid is very apt to be inefficiently performed. It is always difficult to keep one's-self to one line of a subject, such as the musketry training of the Militia, without considering the musketry training on a larger scale as embracing the whole of the Service. I am inclined to think that a very great mistake has been made in increasing the number of rounds in the army; I doubt whether it will improve the shooting; it is always considered a great worry. Soldiers have a great deal to do besides shooting, and if you increase their work day after day, bringing them up to the targets in all weathers and at all times, they get so sick of the thing that, so far from improving the shooting, it will go back. We talk a great deal about the shooting of the Boers as being something that we cannot stand against, and that it would be impossible to make the English troops shoot as well. Why, we used always to thrash the Boers, and at the battle of Boem Platts, in which my old regiment—the Rifle Brigade—took a part years ago, there was no difficulty in taking the Dutch position,—certainly with considerable loss, but it was successfully stormed. In those days the Dutch were far better armed than we were. Now we have an excellent rifle, and are at least on an equality; but with all our great improvements in arms—long-range rifles, breech-loading, and so on—our shooting, as was proved at Majuba Hill, is really less efficient than it was in the days of smooth-bore muskets. Why is that? Because the better the arm we get, the more ammunition we waste in long ranges; so that really our shooting in action is less effective than it was when we had short-range arms, because we throw away our ammunition at long ranges. I believe almost the whole of our target practice should be done at very moderate ranges; it is far better practice. At long ranges you have errors in your rifle, the wind, and various matters to take into consideration, but at a moderate range, if the bullet does not hit, the fault is in the man and not the arm; the errors of wind, and the errors of deviation, are not sufficient to make any practical difference; if the rifle is held true it must hit the target at a moderate range; and I really believe that if our men were first of all taught that their object in action is not to fire away an immense quantity of rounds but to place one shot well, and if they were also taught that they are never to shoot at long ranges, and that battles, as the lecturer very properly said, are not won by the few casualties that occur at long-range shooting, we should then have no difficulty in thrashing the Boers or any one else. In point of fact, the Boers have no target practice; they now and then, in trying a new rifle, fire at a mark or break a bottle or two, but they have no regular target practice, and there are very few Boers in the whole country who fire sixty rounds of ammunition a year, or ever have done such a thing; and the proof that they cannot do so is easy to find. First of all they have no target practice, and as for their shooting, it is always at big game, which they seldom miss. If they fire many rounds the quantity of bucks that would be destroyed in the Transvaal would be something more than that prolific buck-country could afford. This is a very vast subject, and I will not attempt to discuss it further now, but I wish to impress on the Officers present the advantage of short-range firing, both for practice and in action, and to point out the well-attested fact, that the fire which proved so disastrous to our troops in attacking Laing's Neck, and defending Majuba Hill, was delivered at ranges from 40 to 60 yards, whilst our men fired away thousands of rounds at long ranges, and only hit at Majuba Hill three Boers and one horse.

Lieutenant-Colonel Garnham (late 6th West York Militia): I am sure most of the Officers present will agree with me in differing from the opinion expressed within the

last few years by a very distinguished General, to the effect that the British regimental Officer is the person who is to blame for any defects in the shooting of the British soldier; but at the same time I am exceedingly glad that my friend Colonel Walker has given us this lecture, and has appealed to the Officers of the Militia to assist in improving the musketry instruction; because I am perfectly certain that that is a very important factor in arriving at a better result, and that the Commanding and all Officers should make more of musketry than in many cases has been made of it. I feel that very strongly. But I am sorry to say I have to go further than that, as I think, however much the Officers of the Militia may exert themselves to teach their men, it is impossible for them to arrive at a satisfactory result in the present condition of things. The lecturer has alluded to making bricks without straw. Now I think our position is not only that of persons who are called upon to make bricks without straw, but very often after we have been able to get over the difficulty and to make bricks after a certain fashion, we have no opportunity given us for hardening those bricks and making them in any way useful for service. What we want is greater facility in the way of time and place for the carrying out of that important instruction in musketry. Facts are always better than theories, and my regiment happens to be one of those which in 1880 was told off for the purpose of going through the complete course of musketry instruction. I was delighted to hear it, and I may say most truly that I gave every possible assistance in my power; but from the very first I felt it was my duty to point out the fact that the range which we were going to occupy was simply an impossible one. We had to take our men down a valley 600 feet deep, and up again 800 feet on the other side on to a moor, 1,000 feet above the sea, which had been condemned as unsafe and on which good shooting is impossible.[1] We were encamped on peat ground, 800 feet above the sea, which, in the weather they generally have in that district, was so soaked that I was obliged to send the whole of my battalion for three or four nights into billets in the town; and my unfortunate men went through all this wretchedness, and then were supposed to be learning musketry under fair conditions. It may be asked whether under these conditions anybody was to blame. I do not think the regimental Officers were to blame in that case; in fact I know they were not, because I had done my best to represent what would be the probable position. We had made applications to be taken to Fleetwood. There was no fault on the part of the Brigadier or of the Officer commanding the district; everybody helped us in every possible way; there was no want of co-operation or kindly feeling of the superior authorities, but there was the system at the back of all which does not recognize the importance of having places properly prepared for the proper instruction of the Militia. *It was the system which was at fault.* The barracks at Fleetwood were wanted for a few days only for some regiment which required to have its barracks whitewashed, and there was some little expense which might have been incurred, and therefore all our time and trouble were wasted. I was obliged to apply for special permission to have the course brought to an end, simply out of justice to my men; but this permission was refused, and you can imagine how very unsatisfactory it was for a Commanding Officer, who was willing to give every assistance, to find that no good result was obtained from the special instruction. For the first week we were obliged to construct our own butts, for which working pay was refused, and I heard privately that the men complained. They said, "We do not come here to wheel wheelbarrows and to construct butts: we are labourers, we are men in mills, and we want to be taught some soldiering, instead of which we are employed in this way." I think, therefore, what we require is to have the system altered, by which in *all these matters* a strict but mistaken economy prevents the Civil and Financial Departments from seconding the efforts, not only of the Officers who command, but, as I have great pleasure in saying, also the noble efforts of those in high places who accept the reports of our difficulties, and are most willing to do everything they can for us. I quite agree with the lecturer that we want full preliminary musketry training for our recruits. We must instruct our recruits properly at first, but it is essential

[1] The regiment is this year to use the Volunteer range, the evils of the regimental range having been admitted after the result of 1880.

that we should follow it up afterwards. We must also have facilities afforded for Officers getting instruction at Hythe or elsewhere, and I think it fair to notice that not only is there great difficulty in getting Militia Officers appointed to Hythe, but it has happened to me on more than one occasion to be asked if I could use private interest to get young Line Officers admitted there, and the musketry accommodation at those schools is utterly insufficient for the wants of a country armed as this country now is. We must also remember that in many cases Militia Officers have been told that they may go to Hythe at their own expense. Now time was, when money was of very little object to many Officers of the Militia, and I believe that in some regiments there are still a great many wealthy men, but we have now a great many Officers who have come to us from the Line, and who know no more about musketry than the average well-instructed Militia Officer, and all those Officers will require to be instructed; and they are not, many of them, men to whom it is convenient to go and to pay so many pounds out of their own pocket in order to improve themselves in these branches. As to the question of ranges. If no range can be found near a regiment, surely ranges might be prepared where regiments might be moved, the expense of which is in no way to be regarded in comparison with the necessity of making the Militia effective. The regiments should be moved to these places; huts should be built, and they should be trained at proper ranges. Colonel Walker fears that prolonged trainings might injure the recruiting, but I do not think that when we went from three weeks to four weeks there was any diminution in the number of recruits; nor in my own regiment, when we went to the manœuvres for six weeks, did we find that the men came up any the worse. Nobody in this world is more opposed to billets than I am and always have been, and I am proud to think no one has said more in denunciation of what I must call the iniquitous system of putting the Militia in such billets as the low public-houses of this country than I have; but we must remember that the men would sooner go back to a warm billet-fire than go up to a cold wet camp where they have no means of drying themselves; and I think that some Commanding Officers will find that these things will make the Militia less popular. We must teach the men, but we must take care that in teaching them we do not make the service so unpleasant that they will not come to it. The withdrawal of the 10*s.* on enlistment no doubt has affected the recruiting of the Militia, and if, when they come up, they get nothing but musketry and wet jackets, I think we shall find fewer men come than at present. I cordially express my agreement with the lecturer in respect of the question of inspections. It is exceedingly disheartening for a Commanding Officer, who has done all that he can to promote musketry, to find that he does not make a good show on inspection. In 1880 our Brigadier most wisely refrained from any field inspection, and if musketry is to be properly looked after it will generally be necessary to strike out some of those manœuvres which are most pleasing to the Commanding Officers, and of which nobody was fonder than I was myself. I think it cannot but be for the benefit of the Militia that this subject should be brought forward. I may mention, with respect to the range, that it is a fact the range at Caterham, which is used by Her Majesty's Guards, is the property of a Volunteer Corps, and it is only by favour that Her Majesty's Guards can practise there, and they are limited to a certain hour for that practice. I do hope that such a state of things will not be allowed to continue, and that difficulties will be removed from the path of Officers who are anxious to raise musketry to its proper standard.

Lieutenant-Colonel Sir JOHN BURGOYNE, Bart.: As my battalion, the 3rd Bedfordshire, is one of an entirely different type to those of the three Commanding Officers who have spoken, it being entirely agricultural, I wish to say one or two words. I thoroughly agree with every word that has fallen from the gallant lecturer. The difficulties that we have had with regard to musketry have very much increased since July, 1881, and the new system of drilling recruits at the depôt is, in my humble opinion, a most fatal one. It not only checks my recruiting so much that, instead of being up to full strength, we are now 160 men under our strength, but we have not the means of training our non-commissioned officers. As to musketry, no target practice of any sort or kind has been done at the depôt for the last two years. We shall have close upon 300 men when we assemble next Monday who

have had no recruit course at all. Last year, thanks to General Elkington (to whom I think every Militia Officer will acknowledge we owe so much), my battalion was sent to Shorncliffe, to be trained with the first battalion. I mention this, because my battalion is the only one, I believe, in the Service that has been trained side by side with its first battalion, and a greater success could not be; but when I went down to Shorncliffe, full of zeal, thinking that I should have the means of training my men in musketry,—for I thought of all places in the world where I might possibly find a range it would be at Hythe,—to my deep disappointment I had the greatest difficulty even in finding any range at all, and I was only able to shoot a half-battalion: this year I hope to be able to shoot the whole of my battalion; but then, how am I to manage with my 300 recruits? I must either shoot men who have never been through a recruit course, or leave it alone, because there are only twenty-one days remaining, deducting the time occupied in travelling and the Sundays, and how is it possible to adequately train them in the time? There is one other point I would just mention, and that is that I think the authorities should give every Militia battalion at least one non-commissioned officer, who has a Hythe certificate, per company. I have three Captains and my Adjutant, who hold first-class certificates, and six serjeants, and I hope I shall be allowed two more.

Major-General McKAY: Musketry is a subject that I have taken up, as I say, now for nearly thirty years, and when I heard the gallant Colonel's name mentioned to give this lecture, I said, "I will go and hear what is to be said on this subject." I quite sympathize with the Commanding Officers who have spoken with regard to their difficulties about musketry practice. I have experienced it, and unless the Militia have their ranges close at hand—within half-an-hour's walk of where they are located—it will be utterly impossible for them to give that attention to careful musketry training which is essential to their efficiency as an infantry force. I was rather staggered to hear musketry depreciated. We have an axiom in our drill-book that has been laid down ever since manœuvring was codified, and it is this: that all manœuvring is to place a man in the best position to use, not his bayonet only, but his rifle, and unless a man knows how to use his musket, whether he is brought to close quarters or is at a distance from his enemy, he is relying on a thing that will do him harm when it is needed for his safety and for the defence of his country; and you had better take it away from him and give him a club. There are one or two points Colonel Walker has alluded to which I think require a little explanation. One is about the centralization of supervision of musketry training. That of course became a necessity in the introduction of the system in 1853, but it has always been a mistake to suppose that it was ever intended to absolve the General Officer commanding a district, or a brigade, from his responsibility with regard to this essential portion of the training of troops; but I tell you what has happened—that musketry was ignored at the beginning; it was considered an incubus upon our drill, which, as a rule, only occupies an hour. Unfortunately for the success of musketry it occupies time; you cannot go and fire even a squad of ten men ten rounds per man in a minute, as they used to do in my early days, when the men were taken to the butts just before they went on a march, and fired volleys into the target, and if they exceeded an hour the unexpended portion of the ammunition went into the nearest dyke. Though it was laid down as far back as 1837 that the man was to be taught judging distances, the use of his sights, and was to be classified, how many were classified? I never had a lesson in judging distances or in the use of sights all the time I was in the ranks; but when the time came that you put a superior weapon into the soldier's hand, it became necessary that he should be instructed in its use; we must not put a superior thing into a man's hand and say that that inanimate thing is to be superior to the intellect that is to use it. No; if you get a good machine you must instruct men to use that machine; if you get a superior rifle you must instruct the men and develop their intelligence if they are to use that rifle skilfully. A good deal has been talked about Zululand. Why did our men fail there? It is very easy to see why they failed, and I can give many reasons. First of all, you can manœuvre in drill, like a machine; but you cannot make a man shoot as a machine. You must interest him in it; you must give him the why and the wherefore for everything he has to do; and you may rely upon this, that in cases of difficulty he will do that which has been instilled

into him as a matter of principle. When I commanded my regiment, and did a manœuvre, I did not think that I was injuring discipline, or that I was lowering my Officers, by telling them the reason why this was done, and why that was done; and I have even gone so far as to make mistakes and to ask them questions after the day's work had been done as to what I did that was wrong in detail. It gave them interest in their work, and the more you divert a soldier's mind in his instruction, the better. The rank and file is sometimes called a common soldier; it is the business of the Officer to make him by training an uncommon one. The rifle is only an arm of precision in the open in proportion to a man's knowledge of distances, the allowance to be made for wind, the shining of the sun, and so forth. The knowledge of distances is an absolute necessity for an independent use of the rifle in the open. We have taken that knowledge of distances away as a qualification from our marksmen. We have also taken the theoretical instruction test away; and then we are astonished that when the man gets into the open there is failure, the two elements of success in rifle training being removed. You can get a man to any pitch of perfection you please before a target, but take him into the open, as I have seen done in India, and he is nowhere without a knowledge of distances. And now I come to the figure of merit. The figure of merit, you may depend upon it, has a stimulating effect. When two regiments side by side are doing their musketry practice, I would ask, are we to abandon it simply because men are dishonest? Surely we must take higher ground than that? I do not believe that that can be the excuse for doing away with the figure of merit; all I say is, that I hope that time will prove the soundness of the judgment that recommended such a measure. I do not think my old chief, who was a man of the world, would, after his long experience in commanding a regiment, have recommended the figure of merit, unless he had been convinced of the soundness of such a proceeding to stimulate industry and interest in training. Are foreign armies abandoning a figure of merit? Why not go back to the old system of outer, centre, bull's-eye? for I think that by abandoning the figure of merit we are going backwards and not forwards in the cause of our musketry instruction. I quite agree that there is a difficulty in securing good sergeants for Militia regiments, but we experience a difficulty in the Line on our seven years' system. They won't grow like cabbages. They are a great element in the efficiency of our regiments, and the Militia will be worse rather than better off by the short service system. That is my view of the case; and as regards the training of recruits, I have had a little to do with brigade depôts, and I can sympathize with Colonels of Militia regiments in wanting their recruits to be brought together for training a few weeks before the regiment assembles for the annual training. It will give them interest in their recruits, and will also give them the opportunity of having their non-commissioned officers trained preparatory to calling out the regiment. You may rely upon this, that as they have done away with instructors of musketry in the army, they will do away with instructors of musketry in the Militia; and I do not see how the musketry training is to get on in the Militia, without a Commanding Officer has some one man whose speciality it is to work up the regiment to a musketry efficiency. And as to the drill, I do say that there are too many manœuvres. What on earth do we want with them? We do not want show manœuvring; we want practical manœuvres, and we want the time to be devoted to the essentials of discipline and good shooting. I am very pleased to find that an old pupil of Hythe has prepared so good a paper to be read before this audience.

NOTE.—The value of the "figure of merit" in shooting is proved, if proof be required, by the great improvement in the rifle proficiency of the regiments serving in India when the instruction was under the supervision of Colonel, now Major-General, Gordon. It is said it is not a fair measure of efficiency, because the regiments do not fire under like conditions as regards weather. This is too weak. Do the men firing for the Queen's Prize at Wimbledon all shoot under the same conditions of weather, or has any shooting competition, where numbers are concerned, ever taken place where all things have been equal?

Captain READE: After the speech of the gallant General that we have just heard, I venture to state what has occurred for the last eight years in my own regiment, the 3rd Welsh. My regiment goes out into camp 2 miles from Cardiff; the

range is 4½ miles from the camp; we have no means of getting there except by marching. The regiment is composed of 20 companies, and numbers from 1,000 to 1,100 strong. Now anybody conversant with musketry will see how impossible it is to give the men of that regiment, in twenty-seven days, the training that the gallant General has said is so absolutely necessary; and at the risk of seeming a pessimist it does seem to me that musketry instruction, conducted as it has been for eight years in my regiment, is a farce, a delusion, and a snare.

Major-General C. ROBERTSON: There was one sentence in Colonel Walker's paper which particularly struck me as showing the true military spirit which ought to inspire every Officer—the spirit which without cavil cheerfully accepts whatever conditions of service may be imposed by authority—the spirit which ignores impossibilities, which in the midst of difficulties is ever hopeful and fertile in resource, confident that where there is a will there is a way, and that, however adverse circumstances may be now, it is always possible to discover some expedient whereby good results may be obtained. The sentence I refer to was this:—"But it is not our duty to sit still with our hands folded, awaiting the arrival of such reforms as we may think desirable; we have it in our power, independently of all extraneous aid, to do very much towards levelling up the shooting of the Militia if we recognize its importance. It is not so much a question of how much or how little time we devote to it, as of the use we make of it." It may be interesting to mention that two years ago, at a Staff College dinner, I heard His Royal Highness the Commander-in-Chief make use of words exactly the same in spirit. His Royal Highness said: "In these times of change we know there are many Officers who are extremely opposed to many of the regulations which have been recently published; there are some of them which I myself do not like; but when I hear of Officers speaking of the total ruin and inefficiency of the army as the effect of these changes, I have no patience for such words. Let us not fear. The army is not ruined; it may still be relied on to do its duty, to perform nobly whatever services may be required of it. If any mistakes have been made experience will make them known and they will be corrected; in the meantime let every Officer accept the regulations and make the best of them."[1] Is not this exactly the spirit in which Colonel Walker spoke? With reference to the various excellent suggestions made by him for enabling the Militia to devote more time to musketry training, and for improving the methods of instruction, I was rather surprised at his omitting to mention the very obvious idea of making arrangements similar to those made by the Volunteers for enabling all men who have gone through the prescribed course of musketry instruction to practise ball firing at the ranges as frequently as they please, and at any time most convenient to each individual. I do not make this suggestion myself, but it seems so obvious, and likely to prove so effective, that I venture to put a question to Colonel Walker, and to ask him to inform us if it did not occur to him, or if he has considered it and does not approve of it. As regards the method of carrying out the suggestions, if no better could be devised, would it not be practicable to make arrangements for attaching squads of Militia to Volunteer Corps for this special purpose, and of employing Volunteer markers

[1] In the last paragraph of the epitome prefixed to the new edition of the "Historical Records of the King's Liverpool Regiment," recently published, the same idea is expressed in such apt words that it seems worth while to quote the passage:—"Military instructions are not exempt from the changes which time brings to all mundane things. Generations pass away, and others fill their places—the old order changeth, giving place to the new; but bronze cheeks and soldierly devotion were not the prerogative of any single generation, or the product of any special tactical system. It remains for the soldier of the future to enter into the true spirit of their regimental traditions,—to emulate that steady discipline which, no less than personal valour, distinguished those who preceded them,—and we may rest assured that whenever opportunities offer they will illustrate anew the motto of the King's Regiment, and of the Anglo-Saxon race, '*Nec aspera terrent*' (No difficulties dismay)."—"Historical Records of the King's Liverpool Regiment," 2nd edition, p. 40.

and instructors for keeping registers and recording the results of the extra practices of Militia squads?

Captain COCKBURN (late 42nd): There is one very startling statement that has been made this afternoon, namely, that the more rounds you give the men, the worse they shoot, with which I cannot agree, and fancy but few others will be found to do so; but I think every man of observation, who has had the opportunity of proving the fact practically in action, must have been struck with the wisdom of the remark made by the same speaker as to the danger, with long-range breech-loaders, of the men throwing away their ammunition uselessly at long ranges, and I think the great lesson to be taught, not only to the recruit but to the oldest soldier in the army, is to value every round of his ammunition as if his own life depended on it, and never to draw his trigger unless he is pretty certain of hitting his mark. Another observation that went to my heart was as to the non-commissioned officer. Now the non-commissioned officers are the backbone of the army, and of the Militia. You may make a soldier, as far as mere manœuvring goes, in a very short time. I have seen as many as 400 or 500 Coolies who, after a few minutes' drill, drove pigs out of a dense jungle nearly 3 miles broad, keeping their line and distances in a manner that would put into the shade many an old regiment in skirmishing order; but though a soldier may be taught all the manœuvring drill that it is necessary for him to know in actual action in a short time, it takes a long time to make the non-commissioned officers, for they cannot be grown like cabbages, as has been remarked by a previous speaker, and I would add heartily my little weight to that remark, which I am sure must have touched everybody's heart.

Captain TULLY (1st Tower Hamlets]R.V.B.): With regard to the practical application of the instruction of musketry, I will tell you a short story. I am a shooting man. I have shot in the international teams. I have fired from 2,000 to 3,000 rounds in the year, and I have succeeded in walking off with a great number of prizes. I also went through a long course at Hythe. I went to the States, and went one day with some Officers of the army hunting. I took my rifle, and a herd of deer hove in sight. I carefully adjusted my sights and calculated the distances. I fired very carefully and missed. The deer, instead of being frightened, seemed to run straight for me. I fired again and again, and I am sorry to say I missed every shot. Now I have never fired at men, and I ask you to consider for one moment the position of a soldier, even one who has gone through the regulation course, when he is for the first time in his life brought before men armed with rifles like his own, shooting at him and trying to kill him. When the Officer who last spoke refers to the number of rounds being considered as an important element in teaching the soldier to shoot, I would ask the financial authorities to consider whether it is not worth while to give that soldier at least the value of the weapon he is armed with in ammunition to enable him to use it. For, as a pure matter of commerce, I should think that unless he were able to use his weapon it will be throwing the money away; and if you give him a rifle worth from 3*l.* to 4*l.* why should you expect him to perfect himself with a small number of rounds? I think that any expenditure necessary to make him useful in the use of his rifle is justifiable. I do not forget some years ago His Royal Highness the Duke of Cambridge saying the soldiers wanted more ammunition, and they would have to ask the House of Commons for it; and I remember Lord Elcho (now Lord Wemyss) rising and stating if His Royal Highness were to go to the House of Commons and say, We must have so much money for ammunition for the soldiers, we, that is the House of Commons, would have to give it you. If the authorities say they must have ammunition and they must have ranges, the House of Commons would be false to its traditions and its duty if it did not grant the requisition thus made.

Captain the Honourable HAROLD DILLON (4th Oxfordshire Light Infantry): I think one thing which would increase the interest of the Militiaman in shooting would be if the Officers of his company were in all cases to shoot with him. It makes the men take much more interest in the practice if they see the Officer shooting, and there is a friendly competition between him and the men. Those amongst the Officers who cannot shoot well would probably by that means be able to shoot better. Another thing I would suggest is, that all Captains of companies in the Militia should go to

Hythe for a month or two at least. It would also be desirable that the instructor should be a Captain or a man who had been in the army; something more than a subaltern of perhaps three trainings is required. A man who has been at Hythe, even if he has not been in the army, is at all events quicker to detect carelessness on the part of the soldier, both in handling his rifle and in shooting, than the man who goes up for his one month's training in the year. Of course if a man has been in the army he has lived amongst rifles, and can detect carelessness on the part of the soldier in a way which it is impossible to expect from the ordinary Militia Officer who comes up for one month.

Colonel Sir LUMLEY GRAHAM, Bart.: I will only take up your time for one or two minutes. I merely wish to refer to a point which has not been touched upon. No doubt the difficulty of the ranges is felt both by the Line and the Militia in carrying through their rifle practice in a really practical way, and this applies particularly to the second part of the course. It is not only a question of money, as some seem to think, but it is also a question of legislation. Unfortunately there are some landed proprietors who are unpatriotic enough to prefer their own interests to those of the country; and I know cases where there are excellent sites for ranges, but the landed proprietors cannot be induced to let the authorities have them. It appears to me that it is very necessary that Parliament should pass a Bill empowering the Government to take suitable land for the purpose of ranges at a fair price, just as a railway company may acquire land to make a railway. If a Bill were passed through Parliament for that purpose it would be a very important point gained.

The CHAIRMAN: The time has nearly expired, but perhaps you will allow me to say a few words. The provision of ranges comes a good deal under my department, and I know the excessive difficulty there is in persuading any one to let their land, even at high prices, for that purpose,—so much so that a correspondence took place only the other day with a landlord in Ireland, who for the privilege of shooting over a bog asked 300*l.* a year, the land in fee simple not being worth that money. We offered to buy the land at a fair price, but he refuses so sell it, because he knows we must come to his terms. Colonel Garnham said that it was advantageous to have ranges near barracks. A perfectly true remark, but utterly impossible in England. This country is so thickly populated, there are so many houses and farms, that day after day letters are received from landlords whose farmers have written to them to say that a shot has been heard, a pig killed, or something similar, at some excessively long distance beyond the targets. Whether these are exaggerations or not of course we cannot say, but the farmers write to their landlords and want to have their rents reduced on that account. The landlords send on to the military authorities, and state that we must stop the firing over that land. Three days ago a letter was received from one of the richest landed proprietors in England, saying that we were not to fire over his land, because some of the tenants said that they would not take on the farms at the same rent if the firing was continued. What are we to do? unless Parliament will grant the right of taking ranges forcibly, and even then it will be most difficult, because rifle practice cannot be permitted where there is danger to persons. Lately a letter was received from a gentleman residing near Wormwood Scrubbs stating that a bullet had been heard to whistle over his neighbourhood. The result was we had immediately to make estimates to raise the butts at a large cost; otherwise the range must have been done away with, and it is nearly the only one we have near London. Endeavours have been made to procure ranges which would answer for the Volunteers, the Militia, and the Line; but though permission could often be obtained for the Volunteers, because they were more careful, the proprietors objected to the Militia. Only yesterday I had a letter from a gentleman, himself a Colonel of Militia, to say that he did not object to the Line shooting at a range on his property, but he did object to the Militia regiment practising there. There are only about three or four places where field practices can be carried out at long ranges in the North of England. We have large Militia training barracks at Lichfield, where we have no range available, and these would be the most useful training barracks possible if ranges could be provided. I cannot say that I agree with General McKay in all his remarks on this subject. I entered the army

not very long after he did; with different regiments there are different practices; some were good, and some not quite as good. In the good regiments, the musketry instruction was not conducted in quite the slack way he mentions. I was told off as a very good rifle shot, at that time (the rifles were introduced in 1854), to instruct my regiment before we went to the Crimea, and I remember at Sandown, where we shot, our men were made to shoot fairly at 600 yards without any of the beautiful theories of lines of fire, trajectories, &c. I taught them how to aim, and what to aim at; I taught them how to judge distances, so far as I could, and to fire a volley; and I remember seeing a company fire at the targets at 600 yards, not knowing the distance, and I do not think a man of the company, that the target represented, would have escaped a hit of some sort. Much better than that cannot be accomplished with all the Hythe instruction. I entirely approve of musketry instruction in every way; but a figure of merit between a regiment shooting at Dartmoor, in the thick weather, over a rough country, and another shooting in a beautiful climate like Corfu, where there was often not a breath of wind, would be no fair comparison. Judging distances is what we want, and that ought to be carried out without the aid of the stadiometer. When I was commanding a brigade at Aldershot I happened to see a regiment judging distances for the prizes; they were judging distances very well indeed. The men I perceived were looking at the stadiometer by which the instructor was correcting the replies. I told him to turn it round, and then I found, though the men could judge their distances capitally before, afterwards, when the instrument was removed, they did not go near the mark; they were from 100 to 120 yards out. Talking to a district inspector, who had been an instructor at Hythe, I asked him to judge the distance of a cow which was 800 yards off, and he was above 200 yards out. He was a man who has the greatest faith in theoretic instruction. I made a guess at the same cow and went very much nearer, and I had never had any instruction at Hythe, but I had a good eye and was fond of judging distances. A soldier may learn to aim as correctly as possible, but he will not hit a man running while some one else is shooting at him. At the same time I greatly advocate constant rifle practice, and to fire away as many rounds as you can possibly procure; but not so with Militia. Militia never should practise at above 300 yards, with the exception of men selected by the Colonel for further instruction, and if possible they should be encouraged to shoot with the Volunteers.

Colonel WALKER: I regret that I cannot agree with Colonel Evelyn as to the amount of ammunition now afforded being excessive. I quite admit the great claims upon our time, and I quite admit that in the precarious climate we suffer from it is often very difficult to get through; but still I look upon the shooting as of such primary importance, that I should sacrifice almost everything to do it. I can only say that I have never, during the last twenty years, known a case in which we have not been able to get through the amount of firing required, and even this year we found no difficulty in putting my battalion through forty rounds, and going through our inspection quite to the satisfaction of the Commanding Officer. I am glad to find that I am in agreement with him on one point, and that is with regard to the comparative value of firing at short range; upon that we seem all agreed—that excessively long range, at any rate for the present, is not of practical use, and we should do better to limit ourselves to shorter ranges. My friend Colonel Garnham has alluded to the discomforts which men undergo under canvas, and has compared their comfort and efficiency in that condition to that of men in billets. Of course there is a certain amount of discomfort under canvas, but I would willingly at all times submit to it rather than revert to the condemned system of billets. My own battalion has trained for thirteen years under canvas, and when I say that we are situated on the south-west coast of Scotland, I think you will agree with me, it is not the driest climate in Great Britain; but in spite of that we manage to make our men fairly comfortable, and it is not unpopular with them. Colonel Garnham did not entirely agree with me as to the inadvisability of extending the training from four weeks to five or six, and he quoted the fact that there was very little falling off in the recruiting when the training was raised from twenty-one to twenty-eight days, and again that there was no reluctance on the part of men going out for the extra fortnight. I quite agree that there was no practical falling off in

recruiting up to the four weeks, but I do not think it at all follows that that figure should be raised higher. With regard to the extra fortnight for manœuvres I entirely agree there was no falling off whatever. I think it was excessively popular in my battalion, but that was an exceptional thing, and if that had happened every year, I am afraid the evils that I anticipate would occur. I am grieved to find my old friend and instructor, General McKay, to whom, only short of our friend and late chief, General Hay, I owe such little knowledge of musketry as I possess,—I am sorry that he does not agree with me as to the abolition of the figure of merit; but I am afraid Commanding Officers, and Officers who have had experience of shooting both in the Line and in the Militia, will agree that, however excellent in theory that system of the figure of merit may be, it has met with grievous abuses. General McKay will observe also, that while I do not object to the abolition of the figure of merit, I thought something at least might be done to replace it, and I am sure he is more familiar than I am with what I alluded to, namely, the system of the Inter-Regimental Rifle Matches, in which detachments of regiments, and individuals belonging to regiments are fairly pitted against each other when they shoot, not in the presence of their own instructors and non-commissioned officers only, but under the vigilant eye of an Officer belonging to another regiment, who has to testify on honour that the practice has been fairly conducted. My friend General Robertson has asked a question with regard to the possibility of supplementing the scanty time at our disposal during the training by getting our men to shoot during the non-training period. The circumstances of regiments are so different that what might be possible to some regiments might be entirely impossible to others. In my own regiment we do so. In three different towns from which I recruit, we carry on this practice every year; thanks to my friend Sir George Douglas, who commands the Volunteer battalion in that district, and who most kindly places his ranges at my disposal, and during the non-training period we fire from 2,000 to 3,000 rounds; the men are paraded with the utmost regularity, and march to the ranges just as steadily as if they were out for training; but what might be possible in my case might be impossible in others. Captain Cockburn has spoken of the waste of ammunition. Ammunition will be wasted whether men are well or ill-trained in musketry. It is not a question of musketry training; it is one of drill and subordination, and fire-discipline, and therefore it is a little beyond the object of my paper. I know that the best shots in the world, if they are not thoroughly under command, will infallibly waste their ammunition. I am glad to find that Captain Tully agrees with me as to the utter hopelessness of any mere mechanical process of teaching men to shoot, placing them on an equality with men who study in the great school of the hunting field. It is impossible by any mechanical process to make finished, practical riflemen of soldiers, such as the Boers, and other men who are constantly in the habit of shooting at large game for their livelihood. What we can attempt is to make our men equal, if not greatly superior, to the average of the rank and file of other European armies. Another Officer referred to the desirability of all Militia Officers going to Hythe. I heartily agree with him; but I am afraid if he is sanguine about that state of things being introduced, I cannot agree with him there. I know what an enormous difficulty it is to get one Officer to Hythe, and there is a young Officer in this room now who knows how many letters I had to write before I got him to Hythe. Sir Lumley Graham has directed our attention to the desirability of getting Parliamentary powers for the acquisition of ranges, and what he has said has been more than amply confirmed by our gallant Chairman. The case which our Chairman quoted was indeed a strong one, and the fact that an Officer, who himself for a long time commanded a regiment, should have kept a range open to the Volunteers, and have closed it to the Militia, is a very striking example of the difficulties to which we are exposed.

The CHAIRMAN: It was not himself, it was his tenant who took the action.

Colonel WALKER: I am glad to be able to acquit him. But if it be the case that while the ranges are kept open to Volunteers because they are more careful in practice, they are refused to the Militia because they are not so careful, I think I may be said to have proved my case, and that some reform is absolutely and urgently called for. I am sure I should be ungrateful if I sat down without asking you to join with me in giving our hearty thanks to Sir Arthur Herbert for his great kindness in occupying the Chair to-day, and for the keen and lively interest he has always taken in the Militia service.

The CHAIRMAN: I thank you for your kindness, and I beg to ask you all to join with me in voting our thanks to our gallant lecturer, for his very instructive lecture. It has not been a mere theoretical discourse, but it has been a lecture which we have all been able fully to understand and appreciate. I may state that in one year I inspected fourteen Militia regiments, and cannot agree that it is the fault of the inspecting Officer that musketry is not carried out, because where ranges are distant, Commanding Officers usually do not take much interest in the musketry instruction. Many in Ireland begged me not to ask questions upon that subject, but to see how well they drilled. Now the inspecting Officer is obliged, to a certain extent, to conform to the wishes of the Colonel of the Militia, as it is useless to inspect what has not been practised, and I therefore only saw two regiments fire out of the whole lot, and they did not fire so badly. Some of the other regiments I believe never fired at all, but they drilled remarkably well. I beg to return our best thanks to Colonel Walker for his lecture.

Friday, June 1, 1883.

COLONEL SIR CHARLES H. NUGENT, K.C.B., R.E., Member of Council, in the Chair.

MILITARY BALLOONING.

By Lieutenant B. BADEN-POWELL, Scots Guards.

(1.) *Introductory.*

IN dealing with the subject of military ballooning, I propose first of all to take a brief historical view of the uses to which balloons have been put in actual warfare, and of experiments conducted on the subject, and after that to consider in order,—the causes of success and failure in ascents; the relative advantages and disadvantages of captive and free balloons; the means and methods of inflation; and lastly, the question of navigating balloons.

In Clery's "Minor Tactics," we are told that "good information about the enemy's force, position, and movements is the first step towards victory," and in Lord Wolseley's "Soldier's Pocket Book," that "one of the most effective means of learning the whereabouts and doings of an enemy is by means of balloons." This being so, it seems surprising that a body of aëronauts does not form a regular branch of every civilized army.

Balloons, it is scarcely necessary to point out, have been and may be made use of on many different occasions in warfare. They may be carried with the advanced parties, and sent up to ascertain the position of the enemy, and the nature of the country ahead. They may be employed to reconnoitre the enemy's position previous to a battle. They may be utilized in noting the formation and movements of the troops, and position of the reserves during an engagement. They could often be beneficially employed as sentries on outpost duty, and would be exceedingly useful during sieges. Besides this, they may often prove invaluable for escape, communication, or signalling, when other means fail.

(2.) *Historical View.*

Soon after the invention of balloons, just 100 years ago (the first balloon which ascended in public was launched by Montgolfier on June 5th, 1783), military authorities perceived the immense value their employment might prove in war, and in 1793 the French

Government instituted some experiments at Meudon, under Guyton de Morveau, Coutelle, and Conté. The following year a regular balloon corps was formed by a decree, of which the following is a translation:—"Considering the report of the experiments made at Meudon of a balloon carrying observers, the Committee of Public Safety, wishing immediately to make use of this new machine for the defence of the Republic, which presents such valuable advantages, resolved upon the following:—

"1. A company bearing the name of *aërostiers* will be formed immediately, for the employment of a balloon to belong to one of the armies of the Republic.

"2. It will be composed of a Captain, a sergeant-major, who will at the same time act as quartermaster, 1 sergeant, 2 corporals, and 20 men, half of whom at least will be experienced in the trades necessary to this service, such as masonry, carpentry, painting, chemistry, &c.

"3. The company shall resemble, in composition, organization, and payment, other companies, and will receive the same field allowance as other troops.

"4. The uniform to be, coat, waistcoat, and trousers, blue; braid, red; collars and facings, black; buttons as infantry; with trousers and jacket of blue linen for fatigue duties.

"5. The armament of the said company shall consist of a sword and two pistols.

"6. The citizen Coutelle, who has hitherto directed the operations ordered by the Committee on the subject, is nominated Captain of the said company, and is charged to recruit at once anyone he may consider capable of filling the different ranks.

"7. As soon as the company is formed, and even before it is complete, those who have been admitted shall go at once to Meudon in order to be practised in the work relative to this art.

"8. The company of *aërostiers*, during the time they are with the army in the field, shall be entirely subject to military discipline; and under the orders of the Commander-in-Chief. As to the expenditure, it will be taken out of the funds of the Commission of Arms and Ammunition, who will forward the necessary amount to the sergeant-major, and will receive the accounts.

"Signed, &c.,
"*Members of the Committee of Public Safety.*"

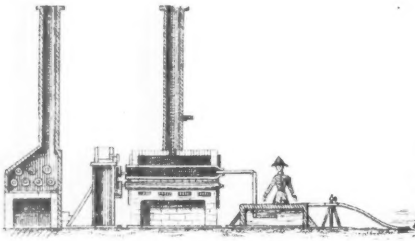
Several balloons were made by these aërostiers of specially manufactured Lyons silk, and were so efficiently varnished that they were said to have remained inflated for two or three months. The first was the "Entreprenant," 27 feet diameter. It could support about 500 lbs., and 10 to 20 lbs. of ballast were taken in the car. The balloons were held captive by means of two cords, fastened to the equator by network, so as to prevent their turning about (which is always detrimental to balloon observation), and which allowed them to rise about 1,500 feet.

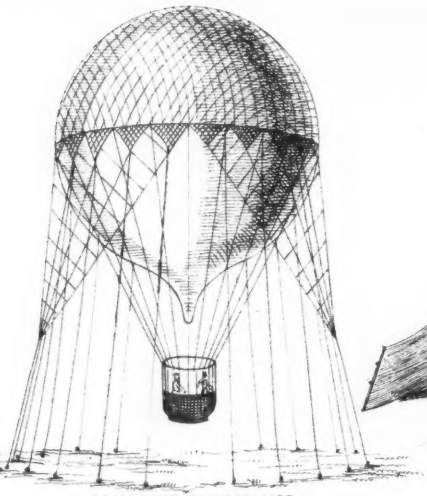
For transporting the balloon, twenty cords were fixed to the equator

Apparatus for making Hydrogen.

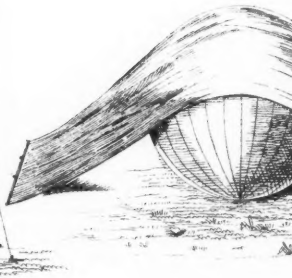
Scale of Feet

5 4 3 2 1 0 5 10 15

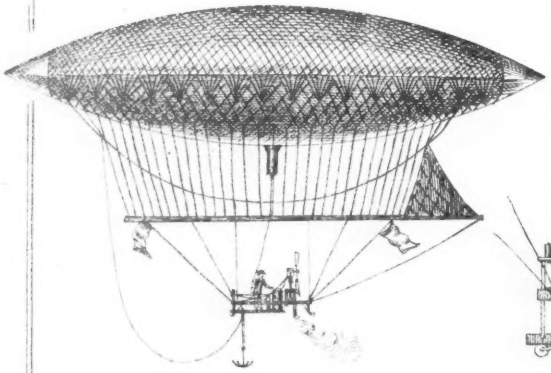


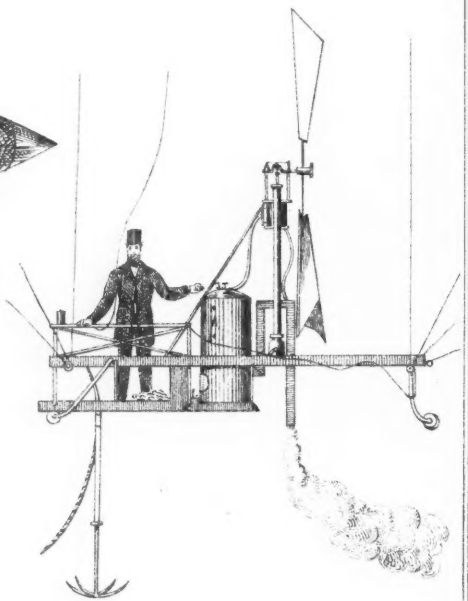


(Balloon under co



FRENCH WAR BALLOON, 1793.





GIFFARD'S BALLOON.

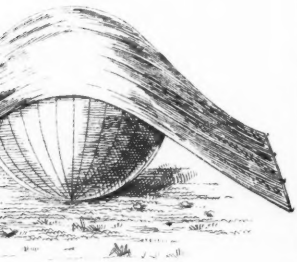
150 feet long.

40 ,, greatest diameter.

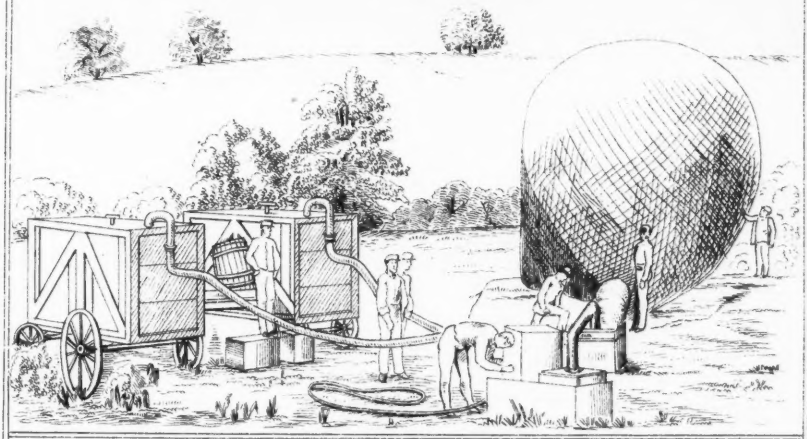
Screw 12 feet across.

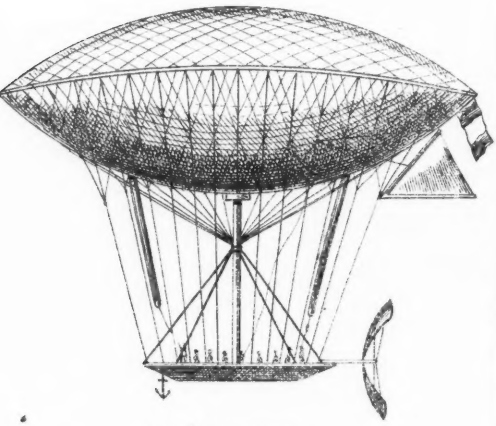
Harrison & Sons, Lith. St Martin

Balloon under cover)



AMERICAN WAR BALLOON, 1863.



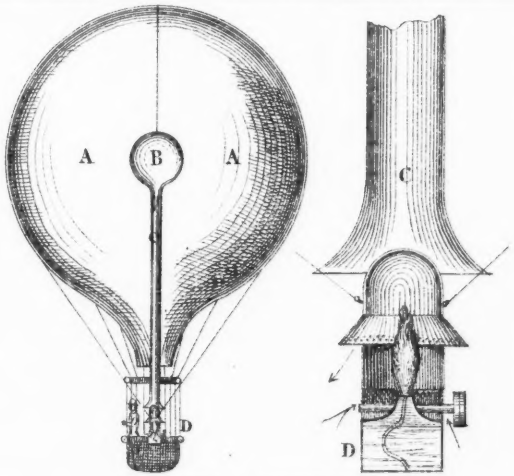


DE LÔMES BALLOON.

117 feet long.

48 ,, greatest diameter.

Screw 30 feet across.



REGULATOR OF TEMPERATURE.

EXPLANATION.

A Ordinary gas balloon (Section).	**C** Gas-tight pipe.
B Small balloon (perhaps metal).	**D** Stove or spirit lamp.

When the stove **D** is lighted, the air in the tube **C** and chamber **B** is heated, which causes the surrounding gas in **A** to be raised in temperature, the lamp can be turned up or down, or the pipe **C** removed, so that the gas can be heated or cooled as required, and the balloon thus caused to rise or fall.

If balloon contains 25,000 c. ft. and the temperature within it be raised 1°, the Gas would expand $\frac{1}{490}$ of 25,000, i.e., 50 c. ft., which would be equivalent to displacing 50 c. ft. of air, or to discharging 3·8 lbs. of ballast.

& Jones Lith. St Martins Lane W.C

by triangular pieces of netting to equalize the strain, and one man was told off to each cord to tow it along. At night it was snugly secured under a large piece of sailcloth. (See Plate.)

A difficulty was experienced in the production of hydrogen gas, as the authorities refused to allow it to be made, as usual, from sulphuric acid, all the sulphur obtainable being required for the manufacture of gunpowder.

Guyton de Morveau, however, suggested a convenient method invented by Lavoisier, of producing hydrogen from steam passed over red-hot iron, and a furnace was built which, after many trials, was capable of producing sufficient gas to fill the balloon in four hours.

Communication with those on earth was kept up by means of signalling with red, white, and yellow flags, similar ones being laid on the ground for answering, and also by notes thrown overboard, tied to little sand-bags, or to loaded arrows, which stuck upright in the ground.

The balloon "Entreprenant" was sent to General Jourdan of the Army of the North, the "Celeste" to the Army of the Meuse-Sambre, and the "Hercule" and "Intrépide" to that of the Rhine-Moselle. Coutelle built a furnace for gas-making near Maubeuge, and on June 18th made an ascent and very successfully reconnoitred the Austrian position. It is a noteworthy fact that this balloon, with the same filling, was serviceable at Namur till July 16th, when it got torn during a storm. During this period it underwent many trials. Constantly the enemy fired at it, its position being noted, and guns were brought to bear on it while low down, ascending or descending. It was taken from Maubeuge to Charleroi, a distance of about 30 miles, towed across country by twenty men, floating at such a height as to permit cavalry and other troops to pass beneath. At the Battle of Fleurus, two ascents were made, each of about four or five hours, notwithstanding a strong wind. All the movements of the enemy were observed and reported. The balloon had a great moral effect on both sides, and the success of the French at this battle is said to have been greatly due to the aid of this balloon. It was found to be preferable to attach the cable to horses or men, rather than to fixed objects, as the strain on the balloon was thus considerably lessened.

So successful was this performance considered, that a second company of aërostiers was formed, to serve as a sort of depôt at Meudon, men and material being sent to the front as required.

During the siege of Mainz in 1799, Coutelle made some ascents during a very strong wind. Of this occasion he writes: "I was at more than 1,000 feet from the ground, when three successive squalls knocked me to the ground with such force that many of the bars that strengthened the bottom of the car were broken. On each occasion the balloon rose with such force and rapidity that thirty-two men at each rope were dragged some distance. It is therefore clear that had the ropes been fixed to anchors they would have broken." He, nevertheless, managed to count the number of the enemy's guns. The Austrians even went to the length of sending out a flag of truce

to request Coutelle to descend from his perilous situation. This shows that balloon reconnaissance is possible even in a very high wind.

The balloons also made ascents at the battles of Ehrenbreitstein, Aldenhove, Liège (when an English General, Money, was a witness of the event, and spoke in most favourable terms of it), Bonn, Andernach, Frankfort, and Wurzburg (where the company were taken prisoners).

In October, 1795, an aëronautic school was established at Meudon, composed of sixty pupils, who were instructed in all details of the construction and management of balloons as well as in all scientific subjects relating thereto.

In a report to the National Convention (1795), the balloon is described as "a new instrument of war which our enemies have recognized as the pioneer to victory," and the report adds "soon all our armies will have complete aërostatic companies, with tents and rigging, which will be as necessary to them as parks of artillery." But General Jourdan did not speak encouragingly of them.

In 1798, Napoleon took a balloon equipment with Coutelle, Conté, and Plazenet to Egypt, but unfortunately for them, the English managed to capture the ship which contained the apparatus. After this the "aërostiers" seem to have gradually died out of notice, and the corps was dissolved, and the balloons sold in 1804. It is said that this was due more immediately to the displeasure of Napoleon at the performance of a balloon which ascended at his coronation, with a large crown suspended beneath it, which travelled all the way to Rome, and deposited part of its crown on the tomb of Nero.

In 1812, the Russians constructed a huge balloon at Moscow, to carry fifty persons, which was to hover over the French Army and rain forth shells and explosives. But their expectations rose higher than their machine, which refused to move off the ground. A balloon reconnaissance was made at the siege of Antwerp in 1815. In 1826 the subject was again mooted by the French, and a balloon was sent to Algiers, but it was never disembarked. The Russians are said to have tried experiments with a balloon at Sebastopol.

The French again used balloons in the Italian Campaign of 1859. They employed the civilian aëronant Godard, and the results seem to have been decidedly unsatisfactory at first, but a useful ascent was made the day before Solferino in a fire-balloon. A few days too late a properly constructed gas-balloon arrived. This balloon was inflated at Milan, taken a distance of 20 miles, and then remained for two days "without suffering any perceptible loss of gas." Nadar, another French aëronant, used a private balloon at Solferino, of 30,000 cubic feet, from which he hoped to take photographs of the battlefield. It was said to have retained its gas and lifted three men after one month. Some reconnaissances were also made in it. A correspondent asserts that the whole 2½ miles of front of the Austrian position was clearly seen.

When the civil war in America broke out, several balloons were used in the operations. On October 4th, 1861, an aëronant named La Mountain ascended in a balloon from McClellan's camp on the Potomac.

He cut the retaining rope and ascended to a height of 1½ miles, when he drifted over the enemy's lines. "Here he was enabled to make a perfect observation of their position, and all their movements." He then rose into another current of air and returned, and descended safely within his own lines. The results which he communicated to headquarters were declared to be "of the utmost importance."

Later on the Federals instituted a regular balloon corps, of which Colonel Beaumont, R.E., has written an interesting account in the Royal Engineer Professional Papers. The balloons were of two sizes, one of 13,000 cubic feet capacity, the other double that size, but the large size was found most suitable. They were made of the best silk, the upper part being composed of three or four thicknesses, carefully varnished with light grey varnish, and capable of retaining sufficient gas for an ascent a fortnight after inflation. Three guys, one of which passed through a snatch-block attached to a tree or other fixed object, held the balloon captive at a height of about 1,000 feet.

Hydrogen gas was used for inflation. It was generated from old scrap iron and sulphuric acid, in a portable apparatus carried on two carts. The iron and acid were mixed in tanks made of wood lined with metal, the gas afterwards passing through lime water. Little more than three hours were required to set up the apparatus and fill the balloon. Two balloons and two generators were taken each on four-horsed wagons, and one two-horsed acid cart. The detachment consisted of one chief aëronaut (Mr. Lowe), one Captain (who never ascended), and about fifty non-commissioned officers and men. The balloon accompanied the advanced part of the army, so as to be useful in reconnoitring, twenty-five or thirty men towing it by cords at a convenient height. Unfortunately the country round Richmond, being thickly wooded, was most unfavourable for balloon reconnaissance, but many valuable details were discovered. Earthworks could be distinguished at a distance of 8 miles, while the piquets and supports of the enemy were distinctly seen. A telegraph wire was sometimes attached to the balloon, so that the aëronaut could at once communicate to the General, or even, as was done one time, to the Government at Washington. Some photographs were also successfully taken of the enemy's position.

The aëronaut and the General each had maps, similarly divided into small squares, which were numbered, whereby the communications were simplified.

On one occasion General Porter ascended, but the cable broke! (owing, it is said, to acid being accidentally spilt on it); he descended, however, within his own lines. "Major Colburn accompanied Professor Lowe in his voyage and made a sketch of the enemy's country that was so correct that Virginians who were familiar with the vicinity of Fairfax Court House at once recognized it, and named the roads, lanes, streams, and houses."[1]

The "Times" correspondent says of the Battle of Chickahominy: "During the whole of the engagement, Professor Lowe's balloon

[1] Putnam's "Records of the Rebellion."

hovered over the Federal lines at an altitude of about 2,000 feet, and maintained successful telegraphic communication with General McClellan at headquarters. It is asserted that every movement of the Confederate armies was distinctly visible and instantaneously reported," and later that "a balloon reconnaissance from Falmouth had disclosed the fact that a considerable portion of the Confederate Army had left Fredericksburg." In an attack on Mississippi Island Number Ten, Engineer-Aëronaut Allan ascended, and directed the artillery fire, communicating the effect of each shot. Balloon reconnaissances were made during May and July, at the bombardment of Yorktown, also at Fairoaks, but this balloon fell into the hands of the Confederates shortly after.

In July, 1862, the first military balloon experiments in England took place at Aldershot. The aëronaut, Mr. Coxwell, was employed to bring one of his balloons which was filled at the gasworks and made many captive ascents, the highest being 2,200 feet. Colonel Beaumont said that "no large movement of troops could take place within a radius of 10 miles without being seen." Later on, some more experiments were made, a 1-inch wire rope being used as cable.

In the war in Paraguay in 1866, a balloon was used at Tuguli. It was managed in much the same way as the military balloons on the Potomac, and the General commanding says he "made from it several very important observations."

When the war between France and Germany broke out, Coxwell went to manage some war balloons for the Germans. He formed two companies (2 officers and 42 men) at Cologne, and made some observations at Strasburg; but such a system was not satisfactory and but little good was done.

During the Siege of Paris, balloons, it will be remembered, were made use of in a more regular and extensive manner, and with most important results. At first two old balloons were anchored at Montmartre and Montsouris as observatories to watch the Prussians. They apparently accomplished but little, although one or two new ideas were introduced. The messages from the balloons were put in a little box which was attached to the cable by a ring, so that the observations were delivered straight to those who held the rope. Every twenty-four hours six ascents were made, four by day and two by night, the latter to observe the camp fires, &c., and it was proposed to use a search electric light.

When the Parisians found themselves cut off from all communication with the outer world, balloons were naturally suggested as a means of escape. Several experienced aëronauts were in Paris, as well as a few balloons. The first aëronaut left Paris in an old leaky machine, which soon came down, but just beyond the Prussian lines. The second took some carrier pigeons to convey back news. M. Godard had two small balloons, neither sufficient for the purpose of escape; but he fixed one below the other, and made a very successful voyage in the "Etats-Unis." The fourth was the last ready-made balloon in Paris, but the success of the employment of the aërial

highway was established, and the Government ordered a number of new balloons to be at once constructed. The chief railway stations, now no longer used as such, were converted into balloon stations and manufactories, and were remarkably suitable for the purpose. The balloons were made of strong cambric, oiled, and of about 70,000 cubic feet capacity, and cost about 160*l.* each. They were filled with coal-gas, and could carry a load of 2,000 lbs., including 600 lbs. of ballast and about 1,000 lbs. of despatches. The first of these, the "Armand Barbés," bore Gambetta beyond the clutches of the Germans. I need hardly refer to the important political consequences of this balloon voyage. Then followed numerous other ascents; one balloon travelled all the way to Norway; another landed on Belle Isle, with a strong east wind blowing. Many were fired at, but few injured. Three balloons fell into the hands of the enemy near Paris, and two in Germany, while one private balloon, with the best intentions, failed to travel even as far as the Prussian lines. Two balloons, each manned by one sailor, were carried out to sea and lost. The average distance travelled was about 180 miles, and the speed varied from 7 to 50, and in one instance, 80 miles an hour. During four months 66 balloons left Paris, of which 54 were specially constructed for the Administration of Post and Telegraphs. About 160 persons were carried over the Prussian lines. Nine tons of despatches, or 3,000,000 letters, were successfully conveyed to their destinations. 360 pigeons were taken up, of which, however, only 57 returned to Paris, but these conveyed nearly 100,000 messages. Of the aëronauts in charge only 12 were professionals, the remainder being chiefly sailors and acrobats.

In June, 1871, the English Government appointed a Committee consisting of Colonel Beaumont, R.E., Lieutenant Grover, R.E., and Sir F. Abel, to enquire into the use of balloons for warfare.

In 1878, Giffard made his great captive balloon for the Paris Exhibition. Although it had no immediate military purpose, a few words upon this marvellous work of art may not be out of place, as showing how successfully a very large balloon may be made, retained captive, and kept inflated under perfect control. It was spherical in shape, 118 feet in diameter, containing 882,900 cubic feet, so that it was capable of raising, when inflated with hydrogen, 27 tons. The car was constructed to hold 52 persons. The cable was a hempen rope 2,000 feet long, tapering from 3·3 to 2·5 inches diameter. A steam-engine of 300 horse-power was used to haul it down, by the means of a large windlass, to which an automatic pneumatic break was applied to prevent sudden jerks. The material of which this balloon was made consisted of seven different layers, of muslin, india-rubber and canvas, put on alternately. The seams were covered with strips of the same materials and were sewn together with 31 miles of strong thread. The outer surface was varnished and painted white. The netting also was of peculiar construction, for, instead of knotting it together, the cords (which were $\frac{1}{2}$ inch diameter) were passed across one another and bound with leather. The lower part of the net was connected by small pulleys so as to equalize the strain. A circular

building had to be specially constructed wherein to manufacture this great aërial ship. The balloon was inflated with hydrogen, produced by sulphuric acid and iron; 190 tons of acid and 80 tons of iron being consumed in the process.

In April, 1879, the English Government instituted an official Balloon Committee, consisting of Colonel Noble, R.E., Sir F. Abel, and Captain Lee, R.E., with whom were associated Captain Elsdale, R.E., and Captain Templer, of the Middlesex Militia, the last mentioned having had considerable experience in ballooning.

Experiments were conducted at Woolwich, and four balloons were made by the Royal Engineers of specially woven fine calico, varnished. A portable furnace and boiler for the manufacture of hydrogen gas was devised similar in principle to the one used by the French in 1793, but with steel sides covered with tiles, and the whole balloon equipment could be carried in three general service wagons. The hydrogen was made by passing steam over red-hot iron turnings, the entire filling apparatus, which had six vertical cylinders, weighed 3½ tons, and was capable of generating sufficient gas for two balloons in twenty-four hours. But the apparatus did not prove satisfactory.

Only a few days after the first experiment an unforeseen adventure happened to a balloon as it was being towed, attached to a cart. The cable snapped and the balloon disappeared in the clouds!

In October one of the balloons was tried free at a review on Woolwich Common, but the wind was unfavourable. The next year the "Crusader" figured at the Brighton Volunteer Review. Captain Elsdale and Captain Templer and nine men managed the balloon. It contained 25,000 cubic feet, and was inflated at the Lewes Gas Works, and towed 2½ miles across country, crossing a tidal river and a railway with telegraphic wires, &c. Two small balloons of 1,500 cubic feet was taken as a reserve supply of gas. The balloon then ascended to a height of 1,500 feet, the mist of the morning and the smoke from some burning furze obstructed the view at first, but later on the weather cleared and a splendid view of the operations was obtained, every man being clearly seen. Finally the balloon "marched past," attached to a four-horse wagon, and then retired at a gallop and returned to Lewes.

In September, 1880, the War Office detailed a whole company of Engineers (the 24th) for instruction in ballooning at Aldershot, and many experiments were made.

Meanwhile, in 1872, the French Government had again determined on establishing a military aëronautical school, and Meudon was again the scene of ballooning experiments. An annual grant of 10,000*l.* was made, and 150 men of the Engineers told off to assist. Since then the establishment has increased, four complete units of ninety men having been formed, each with its own balloons, a portable steam lowering apparatus, and all appliances. The greatest secrecy is kept, and no strangers are admitted to the enclosed premises. Here a large building is erected, capable of holding several inflated balloons, which can be removed at one end. There are numerous other buildings, and plenty of space for experiments. The balloons

are spherical, 10 metres diameter, made of the best silk, and covered with a special varnish, which renders them so gastight that they can remain inflated for a month.

It was proposed to make forty balloons, and it is said that twenty have already been made. The hydrogen apparatus can liberate from 3,500 to 7,000 cubic feet per hour. A liquid which does not readily freeze is used as ballast, so that the discharge can be nicely regulated. A sort of iron harrow is used as anchor, as well as grapnel, when descending in free balloons. For captive ascents a kite-screen is attached to the guy-rope, and communication is kept up by telephone.

English military ballooning received a sudden check when the unfortunate accident occurred to the War Office balloon "Saladin," in December, 1881; but when the Egyptian Campaign commenced it was proposed to send out a balloon equipment to the seat of war. Delays occurred, however, and the decisive battle was fought ere the balloons left England. Four Officers were to have accompanied the three balloons, of 27,000, 18,000, and 13,000 cubic feet respectively. It is greatly to be regretted that they were not sent out sooner, although, as it happened, they could hardly have shortened the war much; but Egypt is a country particularly favourable to their employment, being so flat and open, with few trees, and a steady wind, that much valuable experience would have been acquired, irrespective of the more direct advantages of knowing beforehand the strength and disposition of the enemy behind the Kafr-dawr and Tel-el-Kebir lines.

(3.) *Causes of Success and Failure.*

Having thus glanced at the history of Military Ballooning up to the present time, I will now discuss some of the causes both of success and of failure, after which I will mention a few suggestions for improvements.

It seems that whenever a regularly organized and specially prepared balloon equipment has been employed, it has proved satisfactory. The French "aërostiers" of 1793 really did very useful work; and there is no better proof of this than the way in which the Government increased their numbers. The Americans in 1862 did well, notwithstanding the very unfavourable nature of the country. The Paris balloons of 1870–71 were most successful on the whole, and their employment was of the greatest importance.

For reconnoitring purposes, it is at once apparent that more than one balloon is necessary for efficient observation. It is too much for one man to note the complicated masses of troops moving in various directions and to signal or write down his messages in time. Either two or three men should be observing out of one balloon, or what is better, there should be several balloons at different parts of the field, which could all be filled at the same filling apparatus, and the whole thing done on a more extensive and more systematic plan.

Major Grover, in a very interesting article on this subject in the Royal Engineer Papers, 1863, mentions the following objections which

have been raised to the employment of balloons in war. 1. The chance of being wrecked by projectiles. 2. Difficulty of transporting the apparatus. 3. Difficulty of providing gas. 4. Difficulty of obtaining good trained aëronauts; and 5. Dangers of ballooning. Several other difficulties have also been spoken of, such as 6. Obstruction of view by smoke or otherwise. 7. Difficulty of management in rough weather, and motion of balloon unfavourable to observation.

(1.) First, then, the chance of being wrecked by shots from the enemy. It must be remembered that the balloon would generally be some way behind the first line, and that the enemy would hardly, especially during the heat of a battle, pay much attention to it. It is well to remember that, if only hit by a few bullets, it would not be much damaged and could be very quickly repaired. Both at Frankfort and at Frankenthal the balloons were penetrated by bullets, at the latter place by nine, but the balloon remained up three-quarters of an hour after. In some experiments made at Tours, a balloon was penetrated by bullets at 1,000 yards, but the escape of gas was very slow, and the balloon remained up some time longer.

Again, in 1880, the Siege Operations Committee made an experiment at Dungeness with rather more disastrous results for the balloon. An 8-inch howitzer was directed on a captive balloon, 2,000 yards off, and 800 feet high. The first shot was unsuccessful, the exact range not being known. The second shell, however, burst just in front of the balloon and tore it open. But even then the balloon took fifteen minutes to descend, so that the aëronauts would have been safe. This balloon was, however, only 800 feet above the earth, had it been 2,000 feet up, as it might be when facing hostile guns, it is doubtful if it could have been hit.

Bullets made of spongy platinum have been suggested as a means of igniting the hydrogen in a balloon by mere contact.

(2.) In regard to the other difficulties, the transport has been so simplified that balloon accessories and filling apparatus can be carried on one or two wagons.

(3.) As for the difficulty of providing gas, I think great stress may be laid on the fact that balloons can remain inflated for a long time. We have already seen that this has been done not only experimentally, but actually in the field, the old Fleurus balloon having remained full for a month, making continual ascents, being transported from place to place, and undergoing all the rough usage and hardships of war. So that once filled they may be taken miles away from their filling apparatus, and used day after day, thus still more simplifying the transport. The manufacture of gas will be referred to presently.

(4.) As for trained aëronauts—although it is, of course, preferable that there should be several to each balloon, and that they should be thoroughly efficient—I may say that it is not an *absolute* necessity that an aëronaut should be a civilian, or that he must be trained to the work from his birth; any Officer or man can soon learn the work. We have a good instance of this in the Paris siege balloons. When we reflect that out of the sixty-six balloons, fifty at

least were managed by men who had probably never been in a balloon before, it seems surprising that more did not come to grief. It is curious to note the way in which these men were trained, or rather, given lessons. Some cars were suspended from the roof of the railway stations, in which they were put, told to imagine they were floating in the realms of cloudland, and then directed to pull the imaginary valve-line, &c. It was, as Captain Templer aptly remarked, like learning to swim on dry land. I am sure they would have learnt much more by taking out small balloons into the open air and observing the results of altering ballast, and the effect of the wind on them.

It would always be best to have a good draughtsman trained to the work, as one unaccustomed to it might not feel quite "at home" in the balloon, besides which he would not be able to judge of the features of the ground, which have so peculiar an appearance from above.

(5.) Then as to the danger of ballooning. This is generally much exaggerated. I have elsewhere pointed out that the deaths which have occurred are not more than one to every 1,000 ascents, and that good aëronauts have made over 1,000 ascents without accident. But it is a noteworthy fact how many of the accidents have occurred from one single cause, viz., passengers being thrown or jumping out of the car on concussion with the ground when descending during a strong wind. The unfortunate "Saladin" affair was principally due to this cause, and since then the accident to Sir C. de Crespigny, another to Mr. Simmons, and only a few months ago to a man who was killed in Spain, besides many, indeed nearly all, previous severe balloon accidents, may be ascribed to this one cause.

It seems to me that this fruitful source of misadventure can easily be remedied. It is necessary to prevent the possibility of people leaving the car—whether intentionally, ignorantly, or accidentally. A sort of network placed round the "car-lines" would have this effect, a "doorway" might be left in one side, but I feel sure that in nearly all cases it is best to remain with the balloon, and I believe that such measures would be the means of preventing many accidents.

Another arrangement which might often prove of the greatest value, but which is seldom if ever used in England, is a "tear-rope," so that on emergency a balloon may be torn right up, and thus stopped at once, without any dangerous dragging across country. Although I have never seen a tear-rope tried, I have experienced a balloon being split up on descending in a wind, and at once emptied of gas.

But this applies more to free balloons, whereas in war free ascents would probably be of comparatively rare occurrence, and captive ascents are of course much safer.

(6.) I have myself noticed that the smoke from guns does not impede the view, except perhaps on a very calm day, as much as might be thought. It only exists in front of the guns or line of troops, just where no other troops would be, so that it merely helps to indicate their position to those who can observe from above.

(7.) I think the best proof of the possibility of employing balloons in all but the roughest weather is the fact already noted of the French war balloons of 1793 remaining inflated and making ascents in a very strong wind. At the last Brighton Volunteer Review, 1883, I made some captive ascents during a very strong south-west breeze, and although, owing to insufficiency of buoyancy, no great height was attained, yet I was enabled to obtain a very good view of the field of operations, and was tossed about much less than might have been expected. Indeed, the wind at a good height above the earth would probably always be steadier, and not so gusty as on the ground. On this occasion I was able to use field-glasses quite well.

(4.) *Captive and Free Balloons.*

War balloons may be employed either captive or free, with or without aëronauts.

Captive balloons are no doubt all round the most suitable for war purposes. They are independent of the direction of the wind, can remain for hours in one spot, can be hauled down without loss of gas, and communications easily kept up by notes, telegraph, signals, or telephone. A strong wind is the great enemy to a successful captive ascent, not merely because of the strain on the retaining rope and material, but also because the balloon must have a very great ascensional force to rise, as the wind will, of course, have a tendency to blow it as far as possible to leeward of the point of retention, and therefore downwards. I have found a balloon, capable of ascending to a considerable height when free, hardly able to rise a few feet when held captive, and liable so continually to be blown violently against the ground if the weather be rough.

For this reason the balloon should present as small a surface as possible to the action of the wind. A long cylindrical shape has been suggested as best for this purpose. The French, in 1793, made one of this kind, but apparently it was not very successful. Such a balloon would also possess other advantages over the ordinary spherical shape. It may be filled and kept sheltered from the wind and out of sight and fire of the enemy. It would be easier to transport in a wind or through forests, &c. It could be towed better and would be steadier for observation. But it has the great objection that if the balloon were not quite full of gas, and therefore stiff, the end would be blown in, and offer great resistance to the wind. It might perhaps be stiffened by a framework in front, or, by various means, it could be kept fully inflated. There need be no limit to the length, except the difficulty of suspending the car and the additional weight of material.

A balloon possessing the above advantages might even be used as a means of transport. We have a recent instance of how desirable a canal may be. The air might be navigated by a long balloon, just as a canal is by a long canal boat, in certain circumstances where strong winds are rare and means of communication bad.

Captive balloons could also be used, both by day and night, for

communication, by mooring two or more at intervals, of even 20 or 30 miles in favourable weather, and signalling from one to another.

Small balloons retained by a string have been employed for taking plans of the country beneath by instantaneous photography, an electric wire connecting the apparatus with the ground. Several tolerably intelligible photographs have been taken in this way, and with the improvements which will come with experience, good and rapid automatic surveys of fortifications, &c., may be made; the great difficulty would be to get the balloon over the right spot, or focus the camera in the required direction. Experiments have recently been made in this line, both in the French and German Armies, as well as by Captain Elsdale, R.E.

Small captive balloons, without passengers, have also been used as signals. In the night fight at Kaiserlautern in 1794, lighted signal balloons were employed. Mr. Coxwell has also demonstrated their use. They could be made to take up a search electric light, and they have been proposed as a means of dropping shells into a besieged town, and for many other purposes. The chief advantages thus gained are, a smaller balloon, which is easier to hold down, not so bulky to transport, does not require so great a quantity of gas, is less liable to be injured by the fire of the enemy, and no danger to aëronauts.

Free balloons have the advantage of requiring much less ascensional force than captive balloons, because they have no weight of rope to carry, and no wind to withstand. They are also much steadier when up, and not so liable to be hit by shot; they are very dependent on the direction of the wind, but ascents can always be made. If the wind blow parallel to your front the balloon may be taken to windward, and allowed to travel right down the line. If the wind blows towards the enemy the ascent should be some way back, rapid observations taken, and the descent effected just within your own lines. If the wind blows away from the enemy the process should be reversed. The balloon could always be towed back to the starting point to repeat the ascent. In some cases it would be possible to sail right over the enemy's position, signalling or sending by carrier pigeons all the information you obtain, and descending when you get to friendly climes. In this way most valuable information might be gathered. Finally, adverse currents of air may be made use of, as we have seen was done in the American War; this, although rather risky work, is not so much a matter of chance as many may think. In ordinary balloon pleasure trips taking trouble to reach any particular place is seldom attempted, but when special ascents have been made with this object the results have often been successful. Captain Templer has travelled intentionally from the Crystal Palace to Barnet, another time from the Crystal Palace to Aldershot, another time from Southall to Harrow.[1] Captain Elsdale has also travelled from Woolwich to Colchester by using three different currents of air. A small "satellite" balloon, weighted as required and retained by a fine line, say 1,000 feet long, is useful for ascertaining the direction of neighbouring currents of air.

[1] "Templer on Military Balloons," see Journal, vol. xxiii, No. XCIX, 1879.

Small free balloons without passengers have already been tried in war. In 1793 the garrison of Valenciennes or Condé sent off one with despatches attcahed, which, however, fell into the enemy's camp. In June, 1849, the Austrians made 200 small balloons, each to carry a bomb of 24 to 30 lbs., furnished with a time-fuze. These were to be drifted over the besieged town of Venice; but either the wind changed or the upper currents of air were not favourable, and many of the balloons came back over the assailants, without, however, doing any damage. At Metz, in 1870, a much more successful result was obtained by some artillery Officers, whose balloon travelled to near Neufchâteau, and the despatches which it bore were forwarded to Paris. Shortly after, a small balloon was found in Surrey with letters attached, which proved to have come from besieged Paris. Captain Jones, R.E., has lately been experimenting with balloons of this class.

This system of employing balloons is really one of the simplest imaginable, especially if they be on the hot air principle. A few might always be taken with an army or detachment, and, although communication by their means is not a certainty, yet if three or four balloons with cypher messages were sent up during a favourable wind, with a time-fuze regulated so that they would fall in a given time, according to the strength of the wind, there is great probability of their proving invaluable in case of other means of communication being cut off.

My father, the late Professor Baden-Powell, suggested small balloons for scientific use with the fatal Polar Expedition of Sir John Franklin, and I have a letter from the latter regretting he had not then time to prepare them. Later on, when Sir James Ross was sent out on the search expedition, balloons were utilized, and Sir Leopold McClintock has kindly given me the following interesting particulars of them:—"Balloons were first used in the Arctic regions in 1850, in the Arctic searching expedition under Captain Horatio Austin, for the purpose of distributing papers containing information of the whereabouts of our ships, and the depôts of provisions formed by them for the relief of the missing expedition. These printed coloured papers were tied in little bundles to a slow match which was attached to the balloon—perhaps a dozen bundles of a hundred papers each, as the slow match burnt, the bundles of notice papers were gradually set free. Forty-two balloons were taken; they were of silk, 3 to 5 feet diameter, and the total cost was 164*l*. They were inflated with hydrogen gas, generated by means of sulphuric acid and granulated zinc. Similar balloons were also used in the searching expeditions in 1852-3-4."

(5.) *Means of Inflation.*

One of the greatest difficulties encountered in ballooning on active service is the means of inflation.

The principle of the ascension of a balloon is the rendering its contents lighter than the displaced volume of air. This may be accomplished either by filling with a lighter gas, such as hydrogen or coal-gas, or by heating the air inside so as to make it expand, and

thus make a smaller quantity, and therefore less weight, of air to fill the same space. So that in order to rise, the weight of the air (76 lbs. per 1,000 cubic feet) displaced by a balloon of given volume must be greater than the total weight of the balloon, contents, and all accessories.

Hydrogen is the lightest gas known, and for this reason is the most suitable for inflating balloons, as a smaller quantity of the gas is required, and the capacity of the balloon may consequently be less, and its reduced size has the advantage of offering less resistance to the wind. The objections to the use of this gas are that it is more expensive, and being more subtle, is harder to retain, than coal-gas. Its rate of diffusion is about $2\frac{1}{2}$ times greater than that of coal-gas.

Pure hydrogen is $14\frac{1}{2}$ times as light as air, but when made on a large scale $\frac{1}{6}$ to $\frac{1}{10}$ the weight is generally calculated on. So that 60 to 70 lbs. may be taken as the lifting power of 1,000 cubic feet of hydrogen.

The most usual method of obtaining hydrogen, that used during the American War, is by means of the action of dilute sulphuric acid on iron or zinc. It is simple, and requires but little apparatus. One cubic foot of hydrogen is produced by mixing 4 to 6 oz. of acid with about 20 oz. of water, and putting in 4 oz. of iron scraps. Thus 250 lbs. of iron are required to produce 1,000 cubic feet of hydrogen. Zinc does not give off so much, but the gas is purer and therefore lighter. Steel gives rather more gas than iron does. The gas thus produced costs about 1*l.* 5*s.* per 1,000 cubic feet. (Sulphuric acid costs about 5*s.* 6*d.* per cwt.) I saw a good portable apparatus on this principle tried in Paris, when a balloon of 6,000 cubic feet was filled in four hours. It was said to be capable of generating 3,500 cubic feet in 50 minutes with one charge. The acid is forced into the vessels by means of a hand pump, which compresses the air in the carboy, and drives out the acid. The generating vessels are of iron lined with lead.

Another method of producing hydrogen is by the action of steam on red-hot iron. This process gives a much lighter gas. Iron turnings are put in tubes (preferably of brass, on which the steam has little effect). These are made red hot in a furnace, and a current of steam is sent through the tubes from a boiler. The oxygen of the steam combines with the iron and the hydrogen is liberated, and is passed through a purifying and cooling bath of lime water. The apparatus used by the French in 1793 was on this principle (see Plate); it consisted of seven pipes of cast iron, 3 metres long, by 3 decimeters diameter, each filled with 200 kilogrammes of iron turnings rammed into the tubes; 1 lb. of water was thus converted into 16 cubic feet of hydrogen. Our own engineers have adopted this method, for which but little material is required, iron scraps being abundantly met with in any village or battlefield; but the process is slow and difficult. Giffard suggested passing steam over heated carbonic oxide and native oxide of iron, by means of which the gas could be produced at 6*s.* per 1,000 cubic feet. Hydrogen may also be obtained by passing steam over red-hot charcoal or coke, which does not require so great a heat, but gives a much heavier gas.

About the most simple and rapid method, although practically useless on account of its expense, is the placing a piece of sodium in water, when about 700 times its volume of hydrogen is at once given off. But as the metal at present costs as much as 5*s.* per lb., 1,000 cubic feet of gas would cost 22*l.*

Hydrogen may also be obtained by passing a current of electricity through water, which is thereby decomposed into hydrogen and oxygen, and a small steam-engine might then serve the two purposes of decomposing water and winding the cable.

Coal-gas, such as is used for lighting, is much more convenient for ordinary balloon purposes. It is generally to be found in all large towns, so that in a European War it would probably be best to use this gas, and tow the balloons inflated to any point required. The lifting power of this gas is about 35 lbs. per 1,000 cubic feet, so that nearly double the amount is required to lift the same weight as a given volume of hydrogen. 2 to 2½ cwt. of coal gives about 1,000 cubic feet of gas. Gas of this kind, or "adulterated hydrogen," may also be made from many organic substances, such as wood, peat, grass, &c. Coal-gas may also be made lighter by various processes.

Ammonia has also been suggested for aëronautic purposes. It has much the same lifting power as coal-gas, but has the additional great advantage of being uninflammable, so that a heating apparatus, for causing rise and fall, could easily be applied. It has also the property of being absorbed by water. The great objection to its use, however, is its power of attacking and rotting the material in which it is enclosed. I find that it rots even a pure india-rubber balloon.

It has been proposed to compress gas in steel cases (which might be used as pontoons), but the great strength requisite would make them practically too heavy, and they would have but few advantages over a portable gas-making apparatus.

The original system of Montgolfier, of inflating a balloon by rarefying the air within it by heat, is so simple and rapid that it at once suggests itself as suitable to war balloons. But on the other hand, its lifting power (25 to 30 lbs. per 1,000 feet) is so small, and it is so difficult to retain such a balloon captive, while the danger of catching fire is great, that it has not been found serviceable in actual practice. Godard tried this system at Solferino, but, as we have seen, discarded it in favour of a gas-balloon.

Another plan has been suggested for captive Montgolfiers. The balloon is connected by a long pipe with a powerful furnace on the ground. Thus all the weight of the stove and fuel is done away with, and most of the danger of fire.

(6.) *Material.*

The material of which a balloon is generally made is cotton or silk. Of course the object is to obtain the lightest and closest stuff combined with the greatest strength. This is covered with a varnish, chiefly composed of boiled linseed oil, and often containing india-rubber. It is almost impossible to get a varnish which is really

impervious to gas, that is, which can prevent diffusion, and a great variety have been tried. Balloons have also been made of macintosh, goldbeater-skin, and even of copper. The weight of the material of an ordinary balloon ranges about ·02 to ·05 lb. per square foot. The seams are generally about ½ inch wide, double sewn, and should always be stronger than the material. Balloons have also been constructed without any sewing, the seams being cemented together, so that much time and trouble is saved.

The original Montgolfier balloons of the last century were made of paper or linen, and a stove containing chopped straw suspended below it. This was of course very dangerous, but might now be greatly improved upon by rendering the material fireproof and using some more convenient form of stove. Although it is easy to make linen incombustible, it is not possible to prevent its being charred or rotted by heat. Asbestos has been suggested as a suitable material, but its great weight and expense would prove a serious drawback, although a recent experiment with a balloon partly made of this substance was said to be successful.

The cordage has sometimes been made of silk, in order to be light and strong; and steel-wire rope has been tried as a guy-rope, but it is very liable to kink, which renders it comparatively useless.

(7.) *Navigable Balloons.*

Finally, there remains the question of the extent to which balloons may be guided. It will be at once understood how very much more useful a balloon would be if it could be steered from one place to another. There are two general principles on which it has been attempted to accomplish this object. The first by utilizing the various currents of the air, and the second, by mechanical propulsion.

There are very frequently overlaying one another currents of air blowing in different directions above the same spot, so that it is only necessary for the balloon to rise to some certain elevation to be driven more or less in the required direction; but at present the only means of altering the altitude of the balloon is by the expenditure of gas or ballast, and as the delicately-balanced machine is easily affected by changes of temperature produced by the sun and clouds, it requires a great expenditure of gas and ballast, the life and blood of the balloon, to keep it long in one level. Numerous inventions have been devised for accomplishing this object, such as vertical screws, gas-compressing pumps, &c., but all have their objections. There is one plan which appears to me worth trying. Very shortly after the invention of balloons Pilâtre de Rozier endeavoured to combine the advantages of fire-balloons and gas-balloons, viz., the easy alteration of specific gravity by the application of heat with the greater ascensional power of gas. But he combined them in a very simple and very ignorant way, which resulted in the gas igniting and the balloon being precipitated to the ground. Cavallo and others suggested a Montgolfier balloon suspended some way below a gas-

balloon, so that the latter would assist to support the weight, and yet be out of reach of fire.

Now it seems to me that a powerful lamp might be applied to a gas-balloon without danger, on the safety-lamp principle, and placed some distance from the gas. It might be connected by a tube which would conduct the hot air to a small balloon in the interior of the large one (*vide* Diagram). Then the lamp could be turned up or down as required, and it will be seen that in a balloon of 25,000 cubic feet, raising the temperature 1° would be equivalent to discharging 4 lbs. of ballast. The apparatus could be applied to any balloon, and need not weigh much. The only question is whether the temperature of the gas could be altered with sufficient rapidity to secure the desired practical effect.

Methods of propelling balloons through the air have been devised in hundreds, and, although I believe we can never hope to steer them against anything like a strong wind, yet occasions may often occur in which such machines would be of great practical use.

So long ago as 1852 the French engineer, M. Giffard, ascended from Paris in an elongated balloon, 150 feet long by 40 feet greatest diameter. In the car he carried a small steam-engine of three horse-power, weighing 3 cwt. This worked a screw, 12 feet diameter, 110 revolutions a minute. A triangular rudder was placed behind. The balloon was filled with coal-gas, and the total weight was 3,100 lbs. The experiment was made on a very windy day, but a deviation from the direction of the wind was made, showing an independent velocity of 5 to 7 miles an hour, and the rudder was found to act well.

In 1872, M. Dupuy de Lôme, naval architect to the French Government, made some experiments under Government orders. The balloon used was somewhat similar to that of M. Giffard, and was driven by a screw 30 feet diameter, worked by four men. The balloon in this case, also travelled about 6 miles an hour through the air.

These two are the only really important experiments that have been made in this line. In the first, the balloon was filled with coal-gas; if hydrogen had been used there would have been an available buoyancy of some 3,000 lbs. more for engine! The second took up a party of fourteen persons; if only one had ascended he could have taken up a steam-engine weighing some 1,700 lbs. Dr. Pole has calculated from these data that it will be possible to construct a balloon which could travel at the rate of 30 miles an hour through the air.

Some experiments, on a small scale, have lately been made, also in Paris, with an electric propeller. M. Tissandier has an elongated balloon, 11 feet long, to which a screw is attached, worked by a small dynamo machine, driven by a couple of Planté accumulators. But the action is very slow.

In conclusion, I would remark that in this paper I have endeavoured briefly to put together what is known of military ballooning, both in regard to actual experience and experiment, and to the theory and scientific principles which may be applicable. There is no doubt that much invaluable assistance can be given to the various arms of the

Service by balloons, but to make the most of this assistance we absolutely need more continuous experiment and study. Then we shall undoubtedly have balloons better fitted for campaigning and more under control, even if the actual navigation of the air be deferred some little time longer, and meanwhile Carlyle's words must remain true—"Beautiful invention; mounting heavenward, so beautifully, so unguidably! emblem of much, and our Age of Hope itself."[1]

Major TEMPLER: I am sure we must all thank Lieutenant Baden-Powell for the paper he has read to us. It embraces the history of ballooning from the very first ascent. I do not think I shall be out of place in asking him two or three questions before I state what my own work has been. I should like to ask whether he saw in Paris the Egasse Generator. I do not think the French Government have an Egasse Generator; but I believe the Egasse Generator is capable of generating 20,000 feet of gas, and its weight is 3½ tons. The apparatus the French have in their service weighs 2 tons; it was to carry a load of a ton, and the Egasse Generator is loaded complete at 3½ tons, so that the Egasse is only half a ton more. Then I am not quite certain that Lieutenant Baden-Powell likes the system he proposed for heating the gas by fire in the balloon; because, even if you did attain a result from warming the gas in the balloon, it would be rather against it eventually. It might yield fruit for a few seconds, but my own experience is, the steadier your temperature, the longer the balloon will be likely to float in the air. In military ballooning the weight of the apparatus is the great question that not only occupies our attention but the attention of the French Government at the present moment. Then, as to the weights we want to arrive at. We want a pair-horse wagon to carry an Egasse Generator and its contents—the contents of the one charge of gas, and a balloon, and a rope 5,000 feet in length, at 25 cwt., because we cannot get about with a wagon on service if it has a greater weight than that on it. I think you will see that that will be accomplished. As regards the siege operations that you mention, I do not think there the weights would be so effective. You might have weights there of 6 or 7 tons; I do not think it would be well to limit the weight. I can give you the weights of the French equipments that they have ready now, if it would be of interest. They have their equipment ready to move, and supply equipment ready for their balloon when it is moved at 2 tons 6 cwt. I do not know further particulars about the size of their balloons; I only know that those are the weights. Captain Lee tells me that 17,000 feet is the capacity of their balloons. As you have just told us, the French are very cautious in giving information to any one, and it is rather difficult to get information from them. Allow me again to thank Lieutenant Baden-Powell for bringing the history of balloons up to the present day.

Mr. F. W. BREAREY: May I be allowed to ask a question? I want to find out what has never been understood by the public, and especially by the Society of which I am the Secretary—the Aëronautical Society—how it was that balloons were not sent off in the very first equipment to Egypt. If there is any one who could give us the information it would be very satisfactory.[2]

Colonel BEAUMONT, late R.E.: I have had some little experience in ballooning, and have been asked to say a few words. I do not know really that there is much to be said, because the paper is very exhaustive. At the same time, like most papers on ballooning (and I say it with due deference to the writer), it rather misses the difficulties of the question. And the answer to the question why balloons have not done more than they have done at the present time is not because we are unable to find means to enable them to move, not because it is impossible to drive

[1] Carlyle, "The French Revolution."

[2] This is correct, but the Chairman's reply was *not* satisfactory, because there were facilities within effective distance of inflating the balloons with COAL gas and conveying it where required, therefore no weighty apparatus was necessary. There was something more blamable than neglect in this matter.—F. W. B.

a balloon at a reasonable speed through the air, but simply because we have not been able as yet to invent a steam- heat- or other engine of sufficient power to enable us to store within a reasonable weight what is requisite to impel the balloon. You may ask why should it be more difficult to apply motive power to a balloon than it is to a railway carriage or to a canal boat? The reason is owing to the different circumstances of the case, and the fact that in the one instance you have a fulcrum upon which you can rely, and in the other case the fulcrum is so far wanting that you lose, say, nineteen-twentieths of your power before you can avail yourself of it. I was talking to M. Dupuy de Lôme, who has accomplished one of the successful attempts made to guide a balloon, and I believe the statement of his results has been correctly put down in the paper under discussion. If his view of the case is right, what is really wanting is some exhaustive experiments, which would necessarily take a long time and be extremely costly, to enable the question to be determined, what would be the greatest amount of energy which you could get out of a given weight. I consider, before even looking at it for practical purposes, you would require an engine that would give ten times the amount of power for a given weight that the very best steam-engine that has ever been constructed up to the present time has done. Whether that is a likely thing to be found is another matter—I cannot tell; but that is the way from which the problem should be attacked. I do not know that there is anything else that strikes me of interest at the minute, except perhaps this: that I have no doubt whatever that there is a future before the balloon for the purpose of observation, and especially in the case of a siege. Take the siege of Paris. It might be quite worth while for the defenders, or indeed the attackers, to run considerable risks in obtaining photographs of the enemy's field of operations. I myself saw when I was in Paris a very good photograph that had been taken from a balloon from a height of about 700 or 800 feet. It was clear and distinct in its details. I believe the difficulty that has been experienced up to the present time in photographing from balloons has been not so much to keep the balloon absolutely steady as to keep it at one altitude; because directly the position of the balloon relatively with the earth is altered the focus of the photograph is changed, and it becomes extremely difficult to join the several sheets together. If some means can be taken to keep the balloon at one height, no doubt a series of photographic plans might be taken which would have an enormous value. Again, with reference to the directing of balloons, and how that would influence the case of offence and defence, it would make very little difference indeed to the defenders of a town, because it does not so very much matter, so long as they get out of the citadel, which way they go; but it would be of extreme importance if there could be found some means of obtaining news or getting people or information into a town. It may not be very much to say that you drive a balloon at the rate of 6 or 7 miles an hour through the air; and consequently if a balloon is passing at 20 miles to alter its direction to the extent of say 1 to 3. But you must remember the alteration of the direction of a balloon to even so slight an extent as that may make the difference between striking or missing the place you intended to alight at; and consequently I quite think, with our present appliances, it would not be a hopeless task to communicate with a besieged town if you were to make a series of balloon ascents to windward of the place that you wished to communicate with; and then, perhaps, one out of every three or four balloons that had been started by using the mechanical means available for changing their direction, and at the same time profiting by any chance currents of air, really to alter the direction in such a sense as to make the balloon useful for war purposes in the case of the defence of a town, in order to communicate with it.

Vice-Admiral HAMILTON, C.B.: I should like to ask one question. We have heard a good deal about a balloon being sent up from one side, but I should like to know if it is ever intended to take into consideration what might be the result if balloons were sent up from both sides and happened to meet in the air? Are we to have battles in the air?

Admiral Sir LEOPOLD M'CLINTOCK: By the favour of the Admiralty, I have laid on the table a balloon which we had out in the Arctic Expedition of 1850–51. It is about one-tenth of the volume of the balloons that we generally used to distribute printed messages. It was thought that by means of these balloons numerous

printed papers could be scattered in the Arctic regions, and probably within the reach of some of the people of the missing Franklin Expedition. That the attempt was not successful was not the fault of the balloon, but owing to the fact that the expedition was lost before any of these balloons were sent out from England. I should like to ask the writer of this very interesting paper if he is aware whether anything has been done towards the application of stored-up electric force for the propulsion of balloons?

Lieutenant BADEN-POWELL, in reply, said: I am very much obliged to those gentlemen who have taken part in the discussion, for I am sure they have greatly added to the interest of the paper. I may state, in reply to Major Templer, that it was the Egasse Generator that I was referring to. I have some details as to the weight of engines which Colonel Beaumont referred to. The Thornycroft steam-launch engine, which appears to be one of the lightest, weighs about 600 lbs. for eight horse-power, and consumes 50 lbs. of coal an hour. Professor Ayrton considers that electro-motors are lighter than steam or any other engines, and that one horse-power can be obtained with a weight of 50 lbs., while a French scientist, M. Napoli, has declared that an engine could be made which would only weigh 7 lbs., and would give one horse-power for an hour. With regard to communicating with a besieged town, M. Tissandier made two attempts to get back to Paris from Rouen, but each time the wind was unfavourable. As to whether there would be likely to be aërial battles, I should say the balloons would not be likely to get near one another if held captive; and if they were free, I should very much doubt whether they would ever attempt to approach one another. With regard to the storage of electrical force, the only experiments I have ever heard of in this direction have been those which I have referred to made by M. Tissandier in Paris.

The CHAIRMAN: Ladies and gentlemen, I believe, in order to close the proceedings, I have to discharge the other portion of my task, and to say a few words on what has passed. When Lieutenant Baden-Powell did me the honour to ask me to take the chair, he did so from some knowledge of this particular subject which he fancied I possessed. I mention this lest, in what I am about to say, special weight should attach to my position here, rather than to such knowledge as I do possess. I may first remark that it is a most difficult subject to deal with, because the votaries of aërostation are amongst the most enthusiastic of mortals, and it is hard to bring them back from the realms of mid-air to the regions of sober common sense. The lecturer said that balloons had been pretty much in the state they are now in for the last 100 years. I say it is very much longer than that, for many hundred of years have rolled away without much advance since the first aëronaut failed, and failing gave his name to the Icarian Sea; but, in spite of that, there is a future for balloons, and our object is rather to consider how far and in what way they may be made applicable for military purposes. I think, as Colonel Beaumont remarked, that in the case of rapid operations they are not in the least useful. You must not take what was done at the Brighton review as a criterion; for in that instance they had everything in their favour, inasmuch as there were none of the impediments of war, and the balloon operators could do as they liked. They had very able Officers in command—Major Templer, Captain Lee, and Captain Elsdale; and, therefore, they did accomplish a considerable measure of success. But still I think there can be no doubt that their *rôle* is confined either to siege operations or to operations of war when very large armies are in the presence of one another, such as the armies referred to by the writer in the early period of the French Revolution. When very large bodies are concerned, and it takes time to move them into position, and when if they get into a certain position they may deliver an attack decisively, then it is of great moment to ascertain what is being done upon the opposite side, and then a good deal may be sacrificed in order to bring up balloons, because, after all said and done, the weight you have to carry, either in the apparatus or in generating gas, or in the adjuncts of the balloons, is very great. It is easy enough to say from two to three tons in France, or three to four tons in Germany, but we, for our part working during many years, could never get it down to that, and I think we may double the least of those weights. When you introduce such additional weights into the ordinary operations of a small army it becomes a very serious thing; and I may take the opportunity,

perhaps, here to answer the Secretary of the Aëronautical Society by saying that we never could have made any use of the balloons in Egypt. Firstly, we did not want them: we knew what we had to do without them; and secondly, if we had had them we never could have got them up to the front. Our weight for a balloon equipment was somewhere about 6 tons, and as we had the greatest difficulty in moving ordinary carts with loads of 3 cwt. over the sands, it is certain enough that balloons could not have been taken forward in time to have been of use, and this I can say of my own knowledge, because the question did come before me in some shape. I feel certain that balloons can be usefully employed only where it is a great object to ascertain what your enemies are doing, and when you have unlimited means of carrying weight. I regret that our Government, having achieved a certain measure of success in their operations, which extended over several years, have not gone on. I think fair success was attained, especially in holding a course by making use of different currents of air at varying heights, and as a certain number of men had been trained, it was quite worth while, in my humble opinion, to thrash the thing out; perhaps it will be taken up again some day. With what has been said respecting the employment of balloons in the siege of Paris, I may remark that the balloon is a very bad carrying machine. The balloons employed with lifting power of over 60 tons only carried 6 tons, I think as far as I recollect the figures. When the day comes that the machine which Colonel Beaumont mentions (and he is some authority on machines as well as on balloons)—when the day arrives that a machine so light, so portable, and yet with such motive power may be devised, then there may be a wider field for balloons, but until that does arrive I think their *rôle* is limited. In the siege of Paris, although the besieged sent many balloons out, none of them came back, and this fact tells very much against their general employment. I do not say this in any adverse way; I am not I hope summing up the matter adversely; but it is right in considering this matter that the whole of the conditions should be taken into consideration, and that the votaries of balloons should not be suffered to commence, as Colonel Beaumont suggested, by organizing preliminary conditions. I have nothing further to say, except to thank Lieutenant Baden-Powell for his lecture, and to thank you for having so kindly received it.

Friday, June 22, 1883.

T. CRAWFORD, Esq., M.D., Director-General, Army Medical Department, in the Chair.

ON MILITARY HYGIENE.

By F. S. B. François de Chaumont, M.D., F.R.S., Professor of Military Hygiene, Army Medical School, Netley.

It is now thirteen years since I had the honour of addressing this Institution on the subject of military hygiene, taking for subject-matter the questions: 1st. The Ventilation of Barracks and Hospitals; and 2nd. The Ration of the Soldier. At that time only thirteen years had elapsed from the time of the sitting of the Royal Commission at the close of the Crimean War, an event which proved to be the turning point in the health history of armies. We were then (June, 1870) on the eve of the severest European struggle since the Napoleonic wars of the beginning of the century,—little as the fact was suspected by many who ought to have known better,—and since that time there has been a succession of wars of greater or less importance politically, but fraught with much instruction from a hygienic point of view. Those in which our troops have been directly engaged have been the Ashanti War of 1873, the wars in South Africa, in Zululand and the Transvaal, in 1877–80, the Affghan Campaigns of 1878–79, and the Egyptian Campaign of 1882. With a certain amount of similarity in the circumstances, there were important individual differences which gave a peculiar character to each of these struggles. The first, the Ashanti War, was carried on in one of the most unhealthy even of tropical regions, and the losses by disease were in consequence greatly in excess of the losses by the hand of the enemy, in spite of the rapidity with which the campaign was accomplished. The South African wars on the other hand were carried on in a sub-tropical climate, where the normal conditions are healthy, but where the exigencies of war gave rise to considerable sickness. The Affghan wars were accomplished in a hill climate in the neighbourhood of the tropics, but under circumstances of peculiarity and difficulty, aggravated by the invasion of tropical disease. The Egyptian Campaign was in a country not exactly tropical, but in close proximity to the hottest region of the earth; a country, too, of which our troops had a grave experience in former times as regards health, and of which they retained down to recent times an unhappy reminiscence in the shape of ophthalmia.

In the Army generally very considerable changes have taken place. It has, in the first place, become emphatically a *young* army, and it is gradually assuming a character wholly different from that in which those began their military career who, like myself, have reached the half-century of life. In the second place the foreign service of the soldier is now almost entirely tropical or sub-tropical, the Colonies situated in the temperate zones providing mainly for their own defence. A third circumstance, which has an important bearing upon the health of the troops, is the change in the organization of the Medical Department, the abolition of the regimental system, and the substitution of the unification system in its stead. I propose in the first place to consider briefly the general improvement which may be traced in the condition of the soldier, as shown by the statistics of sickness, death, and invaliding in the general Returns at home and abroad; and afterwards to review shortly the results in the different campaigns above referred to. It is probably in the recollection of those who have given attention to the subject that the sickness and death-rate of our troops at every station was in former times most excessive, at all times exceeding those of civilians of the same ages, even where the actual circumstances seemed in favour of the soldier. If we cast a glance at the older Returns we shall find a condition of things that must excite surprise in any one becoming acquainted with them for the first time, and the simplicity of the means by which the improvement of the present day has been effected would astonish not less, did we not know how the plainest objects are often unnoted from their being actually too near for our vision, just as the most difficult names to find on a map are not those which are in the smallest letters, but those whose letters are exceptionally large and spread over a wide area. In the able abstract by Surgeon-General Balfour, F.R.S., which is to be found in the second volume of the Army Medical Department Reports, that for 1860, we have the following data:—

	Admissions per 1,000.	Deaths per 1,000.
Guards (before 1837)	(no record) ..	21·6
„ (after 1837)	862	20·4
Infantry of the line (after 1837)....	1,044	17·9

In 1860 the following were the ratios:—

	Admissions per 1,000.	Deaths per 1,000.
Guards	737	9·48
Infantry	904	9·95

In 1870 the following were the ratios:—

	Admissions per 1,000.	Deaths per 1,000.
Guards	627	9·16
Infantry	707	7·89

In 1880 the ratios were:—

	Admissions per 1,000.	Deaths per 1,000.
Guards	1,004	7·50
Infantry	944	5·79

The total ratio for the Army at home for the ten years 1870-79 was:—

Admissions ..... 809 Deaths ..... 8·18

And for 1880:—

Admissions ..... 896 Deaths ..... 6·83

There has been thus a steadily diminishing rate of deaths, that is of serious disease. The rate of diminution has been:—

Rate of 1860 was 44 per cent. less than that before 1854.
„ 1870 „ 26 „ „ of 1860.
„ 1880 „ 36 „ „ of 1870.

The general death-rate of the Army at home for the ten years 1870–79 was 56 per cent. below that before 1854, and the rate for 1880 was 62 per cent. below it.

If we now look at the classes of disease which have been thus diminished, we shall find that they are especially those which have been distinctly recognized as preventible by sanitarians, viz., destructive diseases of the lungs and typhoid (or enteric) fever. With regard to the former, we find that the ratio of death from destructive lung disease (included under the head of phthisis or consumption) was, in the period 1830–36, 7·83 per 1,000, and in 1837–46, 7·89, or practically the same, showing no tendency to diminish; and those numbers did not include the deaths from inflammatory disease of the lungs. Thus in the years 1830–36 there were annually in the Foot Guards 10·8 deaths per 1,000 from phthisis, but 3·3 also from other lung diseases, making a total of 14·1. Now the total deaths from *all* diseases in 1880 were only 6·83 per 1,000, or 12 per cent. less than the consumption deaths alone thirty years ago, and 37 per cent. less than the consumption rate of the Foot Guards. The total consumption death-rate of the Army in 1880 was under 2 per 1,000, or 75 per cent. less than the pre-Crimean rate. This eminent improvement has been conclusively proved to be the result of the improved condition of ventilation in the soldiers' sleeping rooms, which has been gradually effected since 1858. But that it is not yet sufficient we know from two sources. In the first place, the amount of air contemplated by the Barrack Commissioners is much smaller than what is now recognized as necessary for the best health and efficiency. But the Commissioners showed wisdom in restricting themselves to requirements which there was a reasonable hope of carrying out, rather than in insisting upon conditions which would certainly at the time have been looked upon as chimerical. The amount contemplated and now given is 1,200 cubic feet per head per hour; but the amount desired in the present

day is just three times that, 3,600 cubic feet, or one cubic foot per second. In the second place, if we compare the phthisis death-rate of the Army with that of civil life, we find it to be still in excess. For that purpose we must take not only the death-rate, but also the ratio of invaliding, for by this the Army gets rid of cases which would otherwise prove fatal, but which go in reality to swell the death-rate among civilians. Of course the effect upon the civil death-rate is hardly appreciable, but the difference that their removal makes on the Army rates is very considerable. Thus in 1880, 4·15 per 1,000 were invalided for this class of disease, and this added to 1·98 of deaths gives a total rate of 6·13 per 1,000 lost to the Army from one class of disease. If now we compare these figures with the civil Returns, we find that the total deaths on the general male population is only *two-thirds* of this, that London shows only 75 per cent. of it, and that the worst districts of England (excluding hospitals) show only 81 per cent. of it, or less than *five-sixths* of the Army rate. The healthiest districts of England, on the other hand, show only 1·96 per 1,000, or 68 per cent. less than the Army rate. Now, when we consider that the Army is a group of selected lives, and that the consumptive recruits who are rejected fall back into the ranks of civil life, it is clear that there is still something that keeps up this serious drain upon the Service. This something, I have no hesitation in saying, is the still imperfectly ventilated barrack room. It is just a quarter of a century since the great change was begun which has been so happily fruitful in saving to the State and health to the soldier; but much still remains to be done. I think it is now time to revise again the soldier's accommodation and to improve it so far as to bring his condition somewhat more abreast of modern sanitary science. The thing of course could be easily done, for it is merely a question of money, but I am afraid the getting of the money will prove the difficulty. The improvement of barrack rooms is less striking than a battle or a brilliant campaign, but its good effects would be more certain and lasting, and the cost not greater. Could we double the space the soldier has in barracks, even without increasing the means of ventilation, an enormous benefit would be obtained, but if we could do both, as we should certainly do if the opportunity were given, there is no reason why the loss from phthisis should be more than in the healthiest district in England. This would be a saving of about 350 men per annum in the home Army alone, and if we take the usual estimate of the value of a soldier at 100*l.* this would be a saving per annum of 35,000*l.* This capitalized at only twenty years' purchase would be 700,000*l.*, which would go a long way in providing the additional accommodation desired. But we should be doing more than this, for we should be thus increasing the number of healthy males destined to be fathers of healthy progeny, and the Army would thus do its part in gradually stamping out consumption in our midst.

Another important group of diseases is the so-called zymotic or febrile group. Among these we find, as the most important in this country, typhus fever, typhoid (or enteric) fever, and small-pox, with

cholera which is only an occasional invader. Of these we may say that typhus has ceased in times of peace to be a matter of anxiety. Two conditions must be present together to give rise to or favour the propagation of this disease, viz., crowding and destitution. Neither of these is now likely to be present among our soldiers, therefore the origination of typhus among them is rendered practically impossible. But the disease once begun is exceedingly contagious, and can be easily communicated from person to person, so that in a serious epidemic no class is free from the danger. The general improvement, however, in the well-being of the poorer classes has to a large extent abolished the causes of typhus in late years, and the health of the soldier has reaped the benefit. In time of war it is a disease to be always feared. It caused immense loss to our troops in the close of the last and the beginning of the present century; it severely scourged the French Army during the retreat from Leipzig; it was one of our direst foes in the Crimea, and it committed great ravages on both sides during the last Russo-Turkish War. It has sometimes been remarked as a curious fact that there was no typhus to speak of during the siege of Metz, but it need not be wondered at, for the compression was not nearly so great as has been the case in other instances, and there was no true destitution; facts in their result which ought to be taken into consideration in estimating the wisdom or good faith shown in the surrender of that important position, a surrender which hopelessly compromised the fortunes of the French in that terrible conflict.

As regards small-pox, the disease has been practically stamped out in the Army at home. During 1880 there were only three cases of the disease in 84,000 men, and the ratio for years back has been exceedingly small, although from the inconvenient form of the Returns it is difficult to state the exact number of cases, mixed up as they are with other eruptive disorders. We may, however, confidently say that the vaccination and re-vaccination of the troops has been so perfectly performed as to reduce the chance of their taking small-pox to a minimum. Among our foreign stations we had similarly small numbers in 1880, the only cases occurring being in Gibraltar, Malta, China, and India, 11 in all and 2 deaths; or a total ratio at home and abroad of less than 9 cases per 100,000, and little over 1 death per 100,000 of strength.

Cholera.—This formidable disease is endemic only in the Delta of the Ganges and Brahmaputra, and perhaps also in that of the Irrawaddy. Its causes are still obscure, as are also to some extent the modes of its spread. We know, however, that it does spread from time to time beyond its usual focus, and that no country is safe from its invasion. We have good proof that hygienic measures, such as the provision of pure water in plenty, care about the removal of excreta and general cleanliness, are powerful means of combating this dreadful enemy. What can be done, when those hygienic means are carried out uniformly and well in a community, may be seen by the diminution of cholera deaths in the Army at home in the last epidemic —that of 1866. In former epidemics the troops had suffered severely

like the rest of the community, but in 1866 there were only 13 deaths out of 70,000 men, and only 17 cases of the disease, which is a very fatal one; the usual mortality being about 2 out of 3 (or 20 out of 30); but in the above group it was even more, 2·3 out of 3 (or 23 out of 30). The above death-rate was little over one-third of the general cholera death-rate of the kingdom in that year. Since that time so much has been done, both in civil and military communities, to improve the sewerage and water supply, that I think it is not too much to say, that even if cholera did reach our shores, it would in all probability fail to establish a foothold.

The remaining group of fevers, namely, enteric (or typhoid) fever, is of much more importance to us than any of the former. Cholera is a mere casual visitor, but typhoid is always with us; typhus arises under conditions that are quickly recognized, and may be rapidly altered, but typhoid is a disease of insidious character, the cause of which often lurks unsuspected; against small-pox we have a safe defence and sure prevention, but we have none such against typhoid. This disease kills in the United Kingdom some 10,000 to 11,000 every year, the total number being about 108,000 for the first ten years (1869–78) after the disease was separated from other fevers in the Registrar-General's Returns. It is a disease which is peculiarly a disease of bad sanitation, arising from either air or water being poisoned by the emanations from excreta, undergoing decomposition in confined spaces. It has often shown itself more a disease of the rich than of the poor, and this for two reasons, it is believed. Firstly, because water-closets and such conveniences have been more generally *within* the houses of the better classes, whilst the poorer more generally resorted to places outside. Sewer air therefore would be less likely in the latter case to get in from ill-ventilated and untrapped drains. Sinks also, and fixed baths are other channels of access for sewer air. The second reason has been thought to be (although this is less certain) the mode of living of the wealthier classes, especially the use of richer and more plentiful food. There is, however, no reason for any one taking typhoid fever, if proper precautions be adopted; drain and soil pipes may be properly trapped and ventilated, sinks and bath-wastes may deliver harmlessly in the open air; and the water supply may be effectually protected from all contamination. In former days we lost a number of men from fever, but this has been gradually diminished. In ten years, 1837–46, there were 620 admissions, and 17 deaths per 10,000 of strength, for continued fever; in the eight years ending 1867, there were only 220 admissions, and 5 deaths per 10,000; in 1871 the ratios were only 9·2 and 2·5 respectively. In the four years ending 1875, the deaths were 3·7 per 10,000; in the five years ending 1880, the deaths were 3 per 10,000, and in 1880, 2·6. If we compare this with the condition of things in civil life, we find that the death-rate, among male adults of the same ages as soldiers, is 10 per 10,000, or nearly four times the Army death-rate. If we look again at the proportion that the typhoid deaths bear to the total deaths, we find that in the Army they are only 4 per cent. of all deaths, whilst in civil life, at the same ages, they are

9·6 per cent., or nearly two and a-half times as great. This result, following as it does on the marked improvements which have been carried out in the sewerage and water-supply of barracks at home, is a strong corroboration of the view which connects typhoid fever with imperfect sewerage arrangements and contaminated water.

Of the other diseases which cause mortality among troops at home, there is one group that attracts attention, and that is, the diseases of the heart and great vessels. This question has been carefully investigated by various medical officers, but particularly by Inspector-General Lawson (retired), by Professor Maclean, of the Army Medical School, by Surgeon-Major Myers, of the Scots Guards, and by the late Professor Parkes. It is certainly a startling thing to find even now that this class of diseases stands second in the list of mortality among soldiers, and causes more than one-seventh of all deaths. Dr. Lawson calculated some years ago that aortic aneurism (a sack-like dilatation to the great artery of the body) was *eleven* times more frequent among soldiers than among civilians. Mr. Myers showed that the deaths and invaliding from heart disease in the Foot Guards as compared with those in the Metropolitan Police were as follows:—

	Died per 1,000.	Invalided per 1,000.
Foot Guards	0·80	3·20
Police	0·29	1·37

They were also greater in the Army than in the Navy to the extent of 35 per cent. of deaths and 50 per cent. of invaliding. Compared with the general population (males between 15 and 44 years of age), Dr. Lawson showed that the deaths from heart disease were 60 per cent. more numerous in the Army than in civil life. In 1880 there died of diseases of the heart and vessels in the Army at home 81 soldiers, there were invalided and discharged from the Service 390, and there were constantly sick 115, so that there were 586 men whose service was lost to the State, or about two-thirds of a battalion. It has further been shown that although the loss is large in all arms it varies with the particular arm. Thus, in the infantry of the line the total loss by deaths is 1·11 per 1,000 (1867–71, for since that time details are wanting); in the Foot Guards, 1·36; in the cavalry, 1·44; and in the artillery, 2·25 per 1,000. Or, taking the infantry of the line as unity, we have 25 per cent. more in the Foot Guards, 30 per cent. more in the cavalry, and 105 per cent. more in the artillery. Considering that the ratio in the infantry is more than double that of civil life, there must be some sufficient cause for this remarkable amount of disease. In civil life rheumatic fever and disease of the kidneys are the two most common causes of heart disease, but neither of these can operate much in the Army. Besides, Dr. Parkes showed that, of the young soldiers invalided in the two first years of service, diseases of the circulation formed 14·23 per cent. of all causes of invaliding. Neither syphilis, nor intemperance, nor excessive smoking, although these might be contributory causes, could account sufficiently for the condition of things observed. After an inquiry of an exhaustive

character it was narrowed down to one set of causes, viz., the work the soldier had to do, and the unfavourable circumstances in which he had to do it. All who are conversant with the subject will admit that the life of the soldier in time of peace is by no means a hard one, that is, he works on the average less than the ordinary labourer or artizan of the classes from which he is taken. Thus, if we take the average daily work of a labourer at a little over 300 foot-tons, the soldier does not do more than about two-thirds to three-fourths of this; or, say, a labourer or artizan may do 2,000 foot-tons a week, whilst a soldier probably does 1,400 to 1,500. Indeed his rations, if he depended entirely on them, would not provide sufficient energy for more than this. But in the work of the soldier we have an element which does not always enter into the work of the artizan or labourer, and that is, the increased velocity of work producing *strain*. The effects of strain in mechanics is well known to all engineers, and the human frame suffers much in the same way as beams, girders, and mechanical engines do. Men who suffer most in this are the artillery, whose drill with their special arm calls for very sudden and violent exertion; next come the cavalry, who are also called upon for sudden exertion, although in a less degree; and, lastly, the infantry, who have to undergo rapid work, such as in doubling, which tells upon the men. Now this is exactly the order in which the mortality from heart and vessel diseases shows itself—the artillery being highest and the infantry lowest. As those exertions, however, are part of the work of the soldier they cannot be altogether avoided, but the conditions under which they are done may certainly be improved, and the necessary evils lessened. Now, formerly the soldier performed his work under very adverse circumstances, particularly in the matter of his accoutrements and his clothing. The effects of the old knapsack and cross-belts are too well known to require repetition here, and much, if not quite all, of the objections have been removed by the introduction of the new equipments. But it is not the same with the clothing, which is still too tight across the chest, at the neck, and round the armpits, tending not only to impede movements, but to distress the man. No civilian would consent to work under the conditions imposed upon the soldier, whilst the sailor of the Royal Navy, who is exposed to at least as hard and sudden work, suffers in a much less degree than his Army brother. Looking to the statistics of successive periods we find that in 1867–71 (5 years) the deaths from diseases of the circulation were in the Army 1·462 per 1,000, and that they formed 16·71 per cent. of all deaths; in 9 years, 1872–80, the deaths were 1·17 per 1,000, and 14·8 per cent. of all deaths; and in the last three years of this period, 1878–80, the deaths were 0·65 per 1,000, and 10·4 per cent. of all deaths. In 1880 the deaths were 0·52 per 1,000, and 9·1 of all deaths. We have here a progressive improvement, no doubt due in large measure to the better arrangements for the carriage of the necessaries. But when we consider that the loss in the Army is still above that in civil life, and that the soldier's life is a selected one, no recruit being taken who shows signs of disease in the heart and vessels, it is obvious that much yet remains

to be done. The percentage of all deaths in civil life, which the circulation deaths show at all ages, is 6¼, between the ages of 15 and 35 it is 6½, between 15 and 45, 8½, whilst between 15 and 25, the ages to which our Army has been tending, it is under 5½. Now, as we have already seen the percentage in the Army for three years, 1878–80, was 10·4, and in 1880 alone still 9·1. Again, those diseases are in the Army second in the scale of mortality, whereas they are only sixth in the list of causes of total deaths in civil life at corresponding ages. Although several causes may combine to produce this grave difference, I am convinced that it is the tightness of the clothing which is still hampering the soldier, especially in his more rapid movements. It is much to be desired that the idea of smartness, which is still associated with a degree of tightness and stiffness of dress, should be got rid of, and that our men should be clothed more in accordance with the work they have to do. There is no reason why the clothing should not be made becoming, and we may instance the Navy; no dress gives a more manly and even graceful appearance than that of a sailor, who is equipped for work primarily; besides, the eye would soon accustom itself to a change really useful, and in the words of Vaidy, "La tenue dans laquelle le militaire est pret à marcher à l'ennemi est toujours belle."

Let me now call attention to some of the changes which have taken place in the statistics of the Army in foreign stations, in some of which changes even more startling than those at home have shown themselves. It is of course impossible to do more than glance briefly at a few, and I may select as typical examples the Mediterranean stations, the West Indies, and our Eastern Empire. The redistribution of our Army has greatly diminished the garrisons in many places abroad, but we still retain a considerable number at Malta and Gibraltar, and a large force in India.

Malta and Gibraltar, from their situations and equable climates, ought to be healthy, and in former times they were really healthier than home stations were. Thus in 1837–56 the death-rate at Gibraltar was only 12·9 per 1,000, or one-third less than that of the Army at home; before 1837 it was not very different from that of the Foot Guards in London. Malta was less healthy than Gibraltar in the second period, but not more unhealthy than the average of home stations, and less unhealthy than London, as represented by the Guards. In 1860 the deaths at Gibraltar were 12·4 per 1,000, but at that time none of the subsequent improvements had been carried out. In 1861–70, however, the ratio was only 8·54, and the average of the ten years 1870–79 was 6·98. The ratio for 1880 was only 4·24, of which 3·57 only were from disease. In like manner in Malta the deaths have been reduced to one-half of the former rates, but they are still too high, as they are 20 per cent. higher than at home for the ten years 1870–79, and 50 per cent. higher than that for 1880. They also exceed those of Gibraltar by 40 and 135 per cent. respectively. What are the diseases that cause this difference? Chiefly continued—that is, enteric (or typhoid) fever. In other words, the drainage of both places is at fault, but more especially that of Malta. But the

sickness at Malta is also too great, being 7 or 8 per cent. above that at home and 20 per cent. above that at Gibraltar. Were it not that a Contagious Diseases Act is in force at Malta, and only imperfectly carried out at Gibraltar, the difference would be more marked still. But it is in the class of fevers that the difference shows itself, the admissions at Malta being 50 per cent. greater than at Gibraltar, and the constantly sick 15 per cent. more. This is due to the existence of a peculiar form of disease, known variously as Malta fever, rock fever, Mediterranean fever, &c., which prevails throughout the Mediterranean shores. It is a painful and protracted disease, as I can vouch for from personal experience, but not a fatal one. It prevails much more at Malta than at Gibraltar, and the cause appears to be defective sewerage. It seems to be a blood poisoning, arising from the soil being more or less saturated with fæcal matter, probably resulting from the practice of cutting drain-channels through the porous rock, instead of laying down impervious pipes. Now the rock at Malta is exceedingly absorbent, whereas that at Gibraltar, being of mountain limestone, is much less so, hence possibly one cause of difference. This defect also tends to the production of ophthalmia; diseases of the eyes are twice as prevalent at Malta as at Gibraltar. All this points to the necessity of remodelling the drainage of Valetta and the adjoining towns and forts.

Turning to the West Indies we find now but small garrisons in the present day compared with those which formerly occupied them; but, such as they are, they present a marvellously improved condition of health upon their state in former times. In 1817–36 the death-rate of white troops in the Windward or Leeward command was 81·5 per 1,000, and in Jamaica 128. In 1837–55 it was 62·5 and 60·8 respectively. In the ten years 1870–79 it was 10·99, and in 1880 only 8·68, or *one-tenth* of the former rate in the Windward and Leeward command, and only *one-fifteenth* of the rate in Jamaica. What were the causes of the former inordinate death-rate and of the great change since? Simply bad hygienic conditions in the one case and their removal in the other, as in all similar cases. In old days the food was bad, the meat nearly always salt, and the use of vegetables was discouraged; the water was generally bad, but rum was only too plentiful. The barracks were totally unventilated, the men slept in hammocks touching each other, there being only 23 inches of width per man allowed, while each had only 22½ square feet of floor-space and 250 cubic feet of total space. And this is the description of the *best* barrack (that at Tobago) in that part of the tropics! No wonder men died at the rate of 10 per cent. in ordinary years and at 25 per cent. in epidemic times. Now all has been changed—food, water, barracks, all have been improved, and we see the result. But there is too much fever and some other diseases, which plainly show that there is still room for improvement.

But our most important possesssion is the great Empire of India, which absorbs one-third of our regular forces even in times of peace. Here we find changes not less remarkable, and of course on a much greater scale. The evidence collected by the Royal Commission

nearly a quarter of a century ago is a mine of information on this important subject. In the first half of this century, in fact down to the Mutiny, the general death-rate of European troops in that country was about 69 per 1,000. In 1812–16 it was 96·5 per 1,000 in Bengal, and in 1819–20, 80 in Bombay. The same causes were found operating, not only dietetic errors and intemperance, not merely heat and malaria, but bad barrack accommodation, a want of proper ventilation, impure water, imperfect removal of excreta, &c. Once these were recognized, steps were taken for their removal, with the usual result —an immediate amelioration of conditions. In 1860–69 the mortality in Bengal was only 31·27, and in 1870–79 only 20·17. In Madras it was 22·5 in 1860–69, and under 19 in the succeeding decade, and in Bombay it went down to 16·37, or considerably under the home rate before the Crimean War. In 1880 the Madras rate was only 10·51, just one-half of the former rate of the Guards in London. This shows to what a low rate the mortality may be brought, and indeed there is no valid reason why this should not be the normal instead of an exceptional rate. As it is, at present we have great fluctuations; thus in Bengal the average of the ten years was little over 20, but the rate for 1879 was 32, whilst that for 1877 was only 12·5, or a difference (taking the latter as unity) of more than 150 per cent. The other Presidencies are not liable to quite such marked fluctuation, but still they are considerable. The causes in Bengal are several, but one of the chief is cholera, which finds its home in the eastern division of it. It is always present there more or less, but every now and then it becomes exacerbated, bursts its usual bounds and spreads into the remoter parts of the province. If we remove the cholera deaths we find that the death-rate is much more uniform and more like that of the rest of India. At the same time the general death-rate is too high, and there is no doubt it can be reduced. There is too much continued fever, that is typhoid, and this is distinctly preventible; there is also too much paroxysmal fever, avoidable by better selection of stations; too much phthisis, avoidable by better barrack accommodation and improved ventilation. The sickness is too large, as well as the death-rate, being twice the rates at home. There is one point that may well be insisted upon, and that is the imprudence of the regulations which confined men to barracks during the most of the day. The motive was good, viz., to keep them out of the sun, but the remedy was worse than the disease, for it compelled them to breathe a foul and tainted atmosphere, which they had again to breathe at night; and it made their lives irksome and monotonous to a degree that was intolerable. Men may be trusted to keep out of the sun without being subjected to such a terrible and destructive ordeal. A proof of what has been said may be found in the fact that those who are least confined to the house in India enjoy the best health. Officers are not so restrained, and their health is better than that of the men; civil servants have to do much of their work in the open air in very hot weather, and they are more healthy still; and planters, who are necessarily active during the day, are the healthiest of all. The Medical Officers on the Madras establishment (as shown by the statistics of the Medical Fund) die at

a less rate than those of the British Army, taking all stations together, temperate as well as tropical. In the words of Miss Nightingale, men may live and not die in India; but the condition is that they shall live hygienically, and surely it is the business of the Government that, in the case of troops, who are not free to choose their way of life, no obstacle shall be placed to prevent the best and most hygienic form of life. I feel convinced that, if the rules of hygiene were properly carried out, the death-rate in India need differ very little from what it is at home, although men will always be handicapped to some extent by excessive heat and malarious influences. But active lives will combat the former, and improved drainage and means of agriculture the latter, whilst we may hope that it is not chimerical to believe that a time will come when cholera will be merely an historical curiosity. In the meantime it is possible even now to protect the young soldier from typhoid fever, cholera, and dysentery, in which case he is actually better off as regards health when in India than he is in barracks at home.

We may now turn shortly to the question of hygiene in time of war. If hygiene is important in time of peace, it is infinitely more so in time of war. There is nothing which so impairs and ultimately paralyzes a force as disease; no loss that the enemy can inflict in battle being at all comparable to it. This has been recognized by all great commanders. It was preventible disease that caused the collapse at Walcheren, that more than once threatened the armies in the Peninsula, and that produced our disasters in the Crimea. In the Walcheren Campaign there was hardly any fighting; but the position was so badly chosen, without any reference whatsoever to medical opinion, that the fate of the expedition was sealed almost before a shot was fired. In three months 2,000 men perished and 10,000 were attacked with disease, which the majority never afterwards got rid of. One-fourth of the entire force perished (8,000 deaths), and the greater part of the remainder filled the hospitals for many a long day.

The history of the Crimean Campaign is well known. By a combination of circumstances, not unlike that of Walcheren, the first army perished, some 16,000 men dying of disease alone, the most of them during the first winter of the campaign. Unlike the Walcheren story, however, the war lasted long enough to enable a recovery to be made, and we had in the second year a condition of health greatly superior to that of the troops at home, and in the spring of 1856 there was hardly a man who could not have marched against the enemy, the number of sick being in many cases under 1 per cent., and these trifling cases, whilst in some battalions there were practically no sick at all.

The diseases which were most fatal at Walcheren were paroxysmal fevers, typhus (and probably typhoid), and dysentery, aggravated by scurvy. These were the result of malarious site, bad water, bad rations, crowding, and inaction. In the Crimea the diseases were typhus and typhoid fevers, diarrhœa, dysentery, aggravated by scurvy, and at certain times cholera. These were due to the same

causes, except the malarious site, which, however, operated on the army in Bulgaria. My colleague, Professor Aitken, has also drawn attention to the marked influence which previous exposure of troops has in diminishing their power of resistance. In the Walcheren Campaign a large number of men had already gone through exhausting service in the preceding years, and in the Crimean War those men who formed part of the Bulgarian Army suffered to a greater extent than the men who went to the Crimea direct.

Putting on one side the Indian Mutiny, in which the circumstances were peculiar, the next war in which our troops were engaged was that in the north of China in 1860. This was of course a small affair so far as the number of troops was concerned. The total sickness and mortality were at the rates of 2,049 admissions per 1,000, and 53·98 deaths, including both North and South China. In the North China force alone the rates were, from May to July, 1620·7 admissions and 22·55 deaths, and from August to November 15, 1823·8 admissions and 65·54 deaths per 1,000 of strength. Fevers, dysentery, diarrhœa, and cholera constituted two-thirds of the deaths, but if they be compared with the preceding years of Chinese experience it will be found that they differed but little, except for the better, from the previous ratios; for in 1859 the admissions were 2,783·2 per 1,000, and the deaths 59·35, a marked proof of the excellent way in which the hygiene of the Army was attended to.

Our next small war was that of Abyssinia 1867–68. The ratio of admissions was only 891·6, and of deaths 36·14 per 1,000 of strength. There was nobody killed in action, but 9·37 died from accidents, so that the actual deaths from sickness were only 26·77, of which 47 per cent. died from dysentery and diarrhœa, less than 10 per cent. from fever, there being but one death from continued, that is (probably) typhoid fever. This is an excellent example of good hygiene in the field.

In the Ashanti Campaign of 1873 the amount of sickness was small if we consider the nature of the country in which the war was waged. This was due to the facts that a suitable season was selected, that the war was carried out with great skill and rapidity, and that the arrangements for the hygiene of the troops were admirably planned and well carried out. As it was, the sickness amounted to about 1,700 admissions, and the deaths to 31 per 1,000 of strength (per annum). The Officers in this campaign actually suffered more than the men. The chief diseases were fevers, chiefly remittent, sunstroke, and heat apoplexy, and dysentery and diarrhœa; but the comparatively small mortality, in an expedition campaigning in one of the most pestilential countries in the world, is a very remarkable circumstance. Now, in all these three campaigns—in China, Abyssinia, and Ashanti—the influence and advice of the Medical Department were allowed very great weight, and as in each case the principal medical Officer of the expedition was a man of great ability and long experience, the Army profited accordingly.

I now come to the most recent operations. Although the campaigns in Affghanistan and South Africa are both interesting and full of

instruction, I should not have time to dwell upon them within the limits of the present lecture. I shall, therefore, refer briefly to the late war in Egypt only. The events of it are fresh in the memory of all, the genius with which it was planned and the consummate skill with which it was carried out. It was waged in the hot season of a sub-tropical region, under circumstances which placed great strain upon every part of the force. Yet the hygienic results are extremely good. Out of a force of 13,013 average strength there were 7,590 admissions to hospital in a period of 87 days, of which 671 were from wounds and injuries, leaving a ratio of admissions for disease of 530·2 per 1,000. If this be expanded into a ratio per annum it becomes 2,222. Of these about 10 per cent. were constitutional and venereal disease, not peculiar to campaigns, so that the total amount may be reckoned at 2,000 per 1,000 per annum; of these only 17 per cent. were febrile diseases, whilst 38 per cent. were diseases of the digestive system, chiefly dysentery and diarrhœa, and nearly 17 per cent. ophthalmia, which is always so common in Egypt. As for the deaths, there were 172 deaths in the whole force, of which 98 were from battle or accident, leaving only 74 from disease, or a ratio of 5·88 per 1,000 for 87 days, equal to 24·67 expanded to a year, a rate not much greater than what the Guards showed in London before the Crimean War. It was even 6 per cent. less than the exceptionally healthy Abyssinian Campaign which had previously stood out as a hygienic model. If to this it be added that, in a country with such an evil reputation for the disease, not one man out of 1,145 cases of ophthalmia lost his sight, and that there was, *for the first time in the history of the world*, a campaign fought without the occurrence of a single case of so-called hospital disease, pyæmia, hospital gangrene, and the like, I think I may well express my opinion that the Army Medical Officers did their duty, and deserved well of their country, in spite of the unjust obloquy which has lately been heaped upon them, but which time will as certainly remove as it has done in similar cases in times gone by.

In conclusion, I wish to call attention to the difficulties which hygiene has to encounter in time of war. Putting aside the necessary exposure to the vicissitudes of climate and weather, the want of food that may occur, or the insufficient character of the rations, and various other *lædentia*, more or less inseparable from a state of war, there is one very serious difficulty, and that is the great compression of population. The most open order of camps in war-time gives a much smaller space per head than the most crowded conditions in civil life, and camps may be so compressed as to give only 8 square yards or less per head. Each person in London has about 96 square yards, in Paris about the half of this, but to give even the Paris allowance would spread an army over a space too great for military purposes. When, in addition to this, drainage has to be extemporized, and the ground covered with latrines, and when pure and wholesome water is a difficulty, it is little wonder that disease breaks out. It is to those circumstances that the typhoid fever, which has characterized our campaigns in South Africa and Egypt, must be attributed in great

measure, as well as in some degree the dysentery. I would suggest, under such circumstances, that fire should be brought more into requisition and everything be burnt that is combustible. It is a standing rule in camp to burn all rubbish, but I would suggest that all excreta should be mixed with combustibles, such as straw or sawdust, if procurable, and burnt. It would even repay the trouble to carry petroleum for this purpose. Similarly, I would, as far as possible, cremate all bodies, which can be done by means of ambulatory furnaces. Could those precautions be carried out, and all water that affords the least suspicion boiled, we should go a long way towards getting rid of some of the most fatal but preventible diseases which attacks troops in the field. If cholera or yellow fever invaded a force, I should advise the burning process to be rigidly applied to all stools and vomit, and none but distilled water to be issued to the troops, if it could be managed.

Although we are far from having solved all the questions of hygiene or of the causation of disease, there are sufficient principles established to enable us to say that, if the rules already recognized were strictly carried out, we should be able to cope successfully with preventible disease, even under the difficulties and impediments which are inseparable from active service in the field.

Mr. Edwin Chadwick, C.B.: May I be permitted as an old Sanitary Commissioner to express my very great pleasure at the paper that has just been read, in the extent to which it displays the operation of sanitation in the Army during peace? The progress I think may be marked in this way. Here amongst the Guards, some twenty years ago, the death-rate was 20 per 1,000. The death-rate amongst civilians of adults of the wage class I take is, in or about Westminster, not less than 12 in 1,000. If a man of that class had formerly enlisted in the Guards it would have been at the expense of nearly a double death-rate, but if he enlists now when the death-rate is only 6 in 1,000, or about one-third of what it is in some years, he will gain proportionately in the duration of his life and working ability. I think even including war risks he would be safer than if he remained a civilian. When these conditions (which admit of yet further improvements) are known it should conduce to the abatement of the present very serious difficulty of recruitment. With a completed sanitary service and complete sanitation, men of the wage classes, instead of having to encounter an insurable large loss of life, may have an insurable small one, with the war risks included. It would add to the interest of the subject if the comparative progress that is making in sanitation in the Armies of France and Germany could be got and stated in detail. But everywhere in civil life, as well as in the Army, the obstacles to sanitary progress are the alleged expense of the measures to effect it. Now this great principle should be known, that a heavily death-rated civil population, as also a heavily death-rated army, is an expensive population and an expensive army. I have no doubt if you estimate the expense of the present conditions in India, where the money saving has been during the last decade upwards of five millions, it will be found to be an economy upon the expenses. Take an example from civil life. In some of the slums the death-rates are as much as 40 per 1,000 as compared to 15 per 1,000, to which it has been now brought in the model dwellings and in a number of urban districts. The death-rate of 40 per 1,000 will include 25 funerals per annum in excess, and beyond that, some twenty times that number of sickness, and also of disablement of more than one-fifth of the cases of adults, and a loss of working ability for several weeks. When all these expenses which must be incurred are added up, it is clear that well conducted sanitary operations may be conducted simply for the saving of money quite apart from the saving of pain and misery, and of

premature mortality. What I have said as to the Army is on the progress of sanitation during peace. I should make a large reserve, especially from the last example, as to any great progress made as displayed in the recent war. There is one point I must take a little exception to, and that is, I cannot concur in the results stated with respect to the recent war in Egypt; and I think Dr. de Chaumont has made a mistake which he ought to correct, namely, in spreading the death-rate for eighty days over the whole year. We have at present an Intelligence Department for getting out conditions that will have to be encountered in war. My opinion is we ought to have an Intelligence Department for ascertaining what is the condition of things that will have to be encountered in other countries, and which may cause us three or four times as great a loss as the loss by the sword. If for instance there had been an early sanitary reconnaissance into Egypt, there would have been—several days before the landing, or immediately upon the landing of the force—a knowledge of the unsanitary conditions to be dealt with, and action could have been taken accordingly, and I believe if there had been a good sanitary reconnaissance you would have found that there were camping grounds well known to all the natives, well known to the doctors of the place as being dangerous to encamp upon, while others close by would have been safe. Such an omission may not have been due to any fault of the General; it might have arisen from the hurry of the war. Lord Wolseley has in his excellent manual given very good instructions as to what should be done on those occasions, that he would require from the sanitary officers an examination and a report on the condition of the camping ground, and upon such report he would be governed as to the stations that he continued to occupy. I might illustrate the fatal mistakes committed with the first army in the Crimea, and how they were corrected by the work of the Special Sanitary Commission for the second army, and how, so far as we at present know, the losses that have occurred in the last, fortunately short, campaign, might have been prevented. However that may be, this paper showing the progress that has been made by sanitation during peace, and the yet further progress that may be expected, I deem a good contribution to sanitary science, and I think thanks are due to my colleague of the Sanitary Institute for the pains he has taken, and I only hope that he may have strength and power to continue them for a long time to come.

General R. MACLAGAN, R.E.: There are one or two points in the paper to which we have listened on which I desire to make a few remarks. Some very important observations have been made on what is known to be a very important matter, the accommodation of our soldiers in barracks. With reference to the amount of cubic space allotted to each man, there are circumstances apparently in which great deviations from the rules on this subject are yet not attended with any hurtful consequence. An advantage seems to be gained when the number of men accommodated within one room is small, though they may not have the amount of floor area and cubic space usually considered necessary. In India, on certain occasions when men have of necessity been accommodated for a time in much smaller buildings than are usually allotted to them, but in which only three or four were in one room, it was remarkable how healthy these men were. In one instance at a station on the frontiers of the Punjaub when an addition had to be made to the number of European troops, and the accommodation was insufficient, a number of the men were for a time put into vaulted apartments under the barracks originally intended for stores. It was meant to be a very temporary arrangement, the rooms being considered quite unsuited for the accommodation of Europeans. However, circumstances required them to be kept there for a considerable length of time, and as a matter of fact, these men so accommodated were among the most healthy of the European soldiers in that province. It would be a very rash thing to generalize from such a fact, and infer that this was a good mode of accommodating soldiers; all we can say is that there must have been some circumstance there which prevented any evil effect from the reduced space available. One reason, no doubt, was that these apartments were much more protected from the sun by day and from the cold by night. Next, with regard to the lecturer's observations regarding the effect on the health of soldiers in India from being confined within their barracks during the long hot day, while other persons who are not so confined and have much out-of-door

duty enjoy better health—(civil Officers, military Officers, engineers, and others)—it should be noticed that for the most part these civilians, Officers, and others who have certainly a great amount of out-door occupation have that occupation just as the soldier has, chiefly in the early morning and in the evening. Civil Officers are generally as much within doors during the day as soldiers, and often under much more unfavourable circumstances for many hours together in crowded court rooms; and though the Officers, civil and military, may often have occasion to be much in the open air, even in hot weather, their families are always as much confined to the house as the European soldiers to their barracks. Their better general health is due probably to their having better general accommodation, better food, plenty of air in their houses, and other advantages; but not to their being less confined to the house than soldiers. On the subject of the amount of cubic space, I think the lecturer observed that 3,600 cubic feet per man was just equivalent to one cubic foot per second. This seems to imply that the whole of the air is renewed in the course of an hour. That I think can scarcely be assumed. There was one very interesting part of the lecture on the connection of work of various kinds with the health of the troops; and notice was taken of the comparative healthiness of cavalry, artillery, and infantry. It would have been of great interest if the comparison had included the engineer soldiers, the sappers and miners, who are generally so much more employed than most of the other men on out-door work. When infantry soldiers have been employed on public works, as they have frequently been in India on hill roads, their health has been particularly good. The employment has been no less advantageous than the hill climate. May I be allowed, with reference to the remarks of the last speaker, to supplement what I said just now on this subject? There is no question that the occupation of the mind of the soldier, besides being profitable in itself, is one of the most important aids to bodily health. In India, a great deal has been done of late years towards providing this in an advantageous way. The men do not now usually occupy the same rooms during the day and during the night. The newer barracks are double-storeyed. In the lower storeys are the recreation rooms and mess rooms, and rooms in which they carry on various occupations during the day. The upper storeys are the sleeping rooms. In trying times of sickness also, the occupation of the mind is most important. On the occasion of a sudden outbreak of cholera among our troops in India, it is found best to move the men at once out into camp or temporary shelter, even at a season when they would never, under ordinary circumstances, be put under canvas, and the immediate occupation of the mind in making the move, the roughing it, the inconvenience serves perhaps as much as the mere change of place and air to fend off the attack of that terrible disease. We have reason to be glad that this subject has been brought before us so fully as it has in the lecture to-day. It is a subject not second in importance to any of those discussed within these walls, affecting so directly and closely as it does the efficiency of our Army.

Major-General DUNNE: Following the Officer who has just spoken with regard to the troops in India and their being kept all day long in their barrack rooms, I may mention that at places like Fort William, in Calcutta, it would be absolutely impossible to allow young troops any freedom, comparatively, of going about in the day in hot weather. My own experience of India as a young man was that a great deal of the sickness amongst infantry when they are first put into barracks in India arose from the fact that they had a large amount of meat and used to drink a large quantity of beer, and that they had nothing in the world from morning to night to amuse their minds. They had no occupation from breakfast time in the morning until 5 or 6 o'clock in the evening. I have no doubt the Officer who last addressed us will corroborate this, that the infantry soldier did nothing but eat a big dinner and then tuck himself under his mosquito curtains and snooze away half the afternoon. I think if more indoor recreation could be found for the men, great improvement would result. No doubt, of late years there has been more occupation found for them. But I think they should not be allowed to go about in the open in the heat of the day. Soldiers could not be trusted—they would have sunstroke over and over again; but to amuse them and give them occupation in barracks is the best thing for them. No doubt why the Engineers are a more healthy body of men in India than the infantry is for the

simple reason that their minds are more occupied and there is more work for them to do during the day.

Colonel BAYLIS, Q.C.: I venture, not being myself one of the regular army, to make a few observations, but with considerable diffidence. Most useful practical suggestions have been made, and they are founded upon the best of statistics. Are these useful measures of prevention to go on? We trust that this lecture will not be without its fruits. We are sorry to see so few attending a lecture of such general importance not only to the Army but to every one. I can only account for it in this way: if you talk of measures of prevention to persons, they are always somehow or other loth to follow them; it is only when something overtakes them with great severity that they will attempt to do anything in the future to prevent its recurrence. And I am not clear but this is the cause of it: it is found that the more successful measures of prevention are somehow or other the less do they appear to be needed, and the less are they followed up by further reform. People do not look at results sufficiently; they say the world is working very well, but they do not look sufficiently at the cause of its working. Now we all allow that a great deal of the present improved sanitary state of the Army is due to precautions which have been taken; and we only hope that the effect of this lecture will be to follow up what has been done and to let these practical suggestions be carried out. The lecturer attributes a great deal of mischief to the tight dress worn in the Army. We know that with ladies appearance goes a very great way, and so it seems to do in military matters. I hope, however, that some practical result will come from this lecture, and that it will be seen that the first consideration is to make the Army healthy and thereby effective. We must all also admit that the occupation of the mind has a great deal to do with the health of the body. I hope, therefore, we shall look after the *mental* occupation of the Army. If whilst doing that, we give the men as much opportunity as possible for following active and healthy pursuits, physical and mental, we shall find less disease and they will not have recourse to those things which so often bring on disease. The suggestions as to the selection of camp sites, and taking precautions beforehand, I think are most important, and I venture to hope they will be carried out.

Dr. DE CHAUMONT: I should wish to say a few words in reply to some of the remarks that have been made. In the first place with regard to what has fallen from my friend Mr. Chadwick on the subject of the statistics of the Egyptian campaign, he must allow me to correct him, for he has not quite apprehended what I have stated. I stated that the total number of deaths from disease during the period of 87 days was 74 out of a total force of 13,000. Now if that is taken as a ratio for those 87 days alone, it gives a ratio of 5·88 per 1,000. But if I expand that ratio to a whole year, that would come to 320 deaths, which upon the 13,000 gives the ratio which I gave of 24·67 per 1,000, and I do not think it would be possible to make it any more. I expanded it for a whole year by multiplying the deaths in the ratio of 365 divided by 87, and that gives 24·67 per 1,000, which I think is an extremely small ratio for a campaign fought under such very adverse circumstances. With regard to the remarks by General Maclagan and also Major-General Dunne, I quite agree that a great deal must be laid to the occupation of the mind of the soldier, and there are no doubt many causes of unhealthiness other than mere confinement to barracks, but speaking of the time of my own experience in India, which I am sorry to say is nearly a quarter of a century ago, there is no doubt at that time men were confined to barracks the whole day and the air was extremely foul, and I think I was able to trace the bad effects of it in the general health of the men. Of course if the men are sent to another room to pass the day it is a good thing, but the main objection I was bringing forward was that the men were confined to barracks in an improperly ventilated air space, which they were again compelled to occupy during the night, and I still maintain at that time the remedy was worse than the disease. The men would not have suffered so much if they had been allowed the utmost freedom in the open air. Of course if it is found that men cannot be trusted to protect themselves from the sun there is no doubt precautions must be taken to protect them, but it must be done in an intelligent way,—in such a way as shall be an advantage to the soldier and not a disadvantage. There was one remark that General Maclagan made with regard to the

amount of fresh air which I suggest as being necessary. He said that this would demand that the whole air of the barrack should be changed every hour. But we not only demand that, we demand three times that. Even in the present day the limited demand of the Barrack Commission is that the air shall be changed in every room at least twice in the hour in order to give a man 1,200 cubic feet. He gets 600 cubic feet of space, and if he ought to have 1,200 cubic feet of air the air must be changed twice in the hour, but we say the air *may* be changed three times in the hour. I think it is quite possible we may get increased space and 3,600 cubic feet per hour for the soldier by-and-bye. And this brings me to another point that was referred to also by General Maclagan, namely, that the case has occurred more than once where men have been placed under apparently adverse circumstances, as for instance where they have not been allotted the full amount of cubic space, and yet have maintained very good health. I do not deny that at all; I think it is quite likely, but other circumstances must come in, and I would here point out what is very often forgotton, or not understood, that cubic space itself is no substitute for ventilation, that is to say what we want is that men should have fresh air delivered to them; it must be delivered in such a way as will be without injury to them in the way of chilling them, or being otherwise unpleasant, but they must have a certain amount of fresh air, and it is perfectly immaterial how it is given, but under no circumstances can cubic space ever be permitted to take the place of fresh air. Many men think if you put the men in a large room, that is all that is required, but if you occupy the room for a few hours shut up, it will be poisoned just as much with 10,000 cubic feet as if it were 100. If it is impossible to deliver a sufficient amount of fresh air and a man occupies only 600 feet of space, it is obvious you must give him more, but this is merely with reference to the practicability of a continuous delivery of air. A man may keep his health perfectly if he is only occupying 100 square feet of space if he could be provided with a sufficient number of cubic feet per hour, or he might attach a respiratory apparatus to his mouth and nostrils, and in the foulest atmosphere you might keep him alive and healthy by bringing fresh air to him and taking away the foul air. The cubic space is quite a side issue with regard to the actual ventilation, so that in these cases where men have been apparently crowded together, in all likelihood the fact has been that there were large openings through which fresh air could very easily be brought in. Men are very often crowded together in the open air, and if the crowding is not too excessive they may keep their health. I might have added, as has been suggested, the statistics of other armies, but it would have rather prolonged the lecture. I may merely mention that the experience of our own Army is by no means unique, and that if we study the results obtained in the French, German, and Austrian Armies, we find that the same conditions produce the same evils, and the same remedies have produced similar results. The death-rate in the French Army has been reduced at least one-half both in France and in the Colonial service. In Germany and Austria the same thing has occurred; with improved measures of sanitation, especially improving ventilation and sewer arrangements, they have got rid of a very large amount of disease, but there still remains the instructive fact that in the foreign Armies there exists a very large amount of preventible disease that we are gradually getting rid of. For instance, typhoid fever is only too common among the French soldiers. Anyone who has experience of the abominable way in which the excreta or sewage is dealt with in France will easily understand why this should be, and why such diseases as typhoid, diphtheria, &c., should rage in foreign cities when they are a very small item in the death-rate here. I will just remark with regard to this, the difference between what we do in this country and what is done abroad. My friend Dr. Ballin, Professor of Hygiène at the Val de Grâce, told me the conclusion he had come to was this: "Your streets" he said, "in your cities, particularly London, are filthy dirty, and your sewers are simply abominable, but your houses are admirably clean, and you have a copious supply of water, and therefore you are healthy. In Paris," he said, "our streets are beautifully clean, you might have a dinner party in the sewers; but we keep all the filth in our houses and the water supply is totally insufficient: the result is we are decimated with disease. After all," he says, "your system is the best" and I think we may say so too.

The CHAIRMAN: I cannot pass over the discussion which has taken place on this able paper of Dr. de Chaumont's without adverting to a subject with which, however, he does not deal at all, and that is camping. Mr. Chadwick has stated that there is great fault to be found with camping ground in Egypt. I need hardly tell my audience here that an army in the field cannot always choose its camping ground; it must camp where its General wants it. I must say, however, from what I have heard both here and elsewhere regarding the selection of the camping ground at Cairo, that the only camping grounds that could have been occupied were those which were occupied, and that the authorities who determined to camp the troops in the place where they were encamped at Cairo had the very best information on the subject, namely, the advice of the Khedive of Egypt and his staff. I feel it necessary to say this in justice to the advisers of the General and to the General who commanded the Army in Egypt, than whom I fancy there is no more competent sanitary or strategic General perhaps in our Army. I think it right also to say that the Army was well advised by a very competent sanitary Officer who was on the staff of the Quartermaster-General in Egypt. With regard to the paper, I have one single remark to make, and that is that the whole of this admirable narrative, based as it is on statistics which do not admit of being disputed, shows if anything can show clearly and very logically too, that we are certainly on the right road to secure for our Army the best possible health consistent with the conditions under which soldiers must serve, and, therefore, I hope that the result of this admirable lecture, containing as it does information on the subject given to us in previous years by the same author, will be that the Government will be stimulated to continue those sanitary efforts which have done so much for the health of the Army, and for the saving of life in the Army, and that thus the ranks of the Army will become more and more popular and its efficiency more and more marked. With these very brief observations I would ask you to give our distinguished lecturer a very warm vote of thanks. Although our audience here is a limited one, yet it is a very influential one, and when it is borne in mind that this lecture through the medium through which it will be published will address itself to almost every Officer in the British or Indian Armies, I have no doubt that you will think that the hour devoted to the consideration of this subject this afternoon has been extremely well spent.

Friday, June 29, 1883.

COLONEL THE EARL OF WEMYSS AND MARCH, A.D.C., in the Chair.

MAGAZINE RIFLES AND REPEATERS.

By Lieutenant-Colonel G. V. FOSBERY, V.C.

IT is now little more than a year since I appeared before you in this theatre[1] to advocate a change of armament, demanded in my opinion alike by the increase of our mechanical knowledge, the new elements introduced in the art of war, but beyond all by the serious steps taken or contemplated by our neighbours in the same direction.

I advocated, as you may remember, such a change with considerable hesitation, knowing as I did how weighty were the opinions which ranged themselves on the side of the *status quo*, and I put forward the views I myself entertained, asking you rather for serious consideration and careful criticism, than for any unqualified assent to my propositions.

I was gratified as well as surprised to find how large a number of those then present gave me their adhesion, and agreeing to the broad principle for which I contended, only differed, when they did differ, as to minor details and the classes of arms which should have the preference. The subject, moreover, seemed to possess an interest for which I confess I was unprepared, and I have been thus encouraged to bring before you to-day some account of the progress since made both here and abroad, and give such information as may serve to keep us properly posted up in the whole question.

That infantry training and instruction is receiving at this moment earnest attention is proved by several indications. Now, as this training must precede and accompany any change of armament, unless indeed we are content to throw away our money altogether, or accept for it but a fraction of its value, it may not be amiss, before commencing our study of the arms themselves, to glance at the character of the training on which will depend their practical value in the hands of our soldiers. At this time last year you may perhaps remember that I pointed out how inadequate would be any supply of service ammunition which any Government would consent to pay for, to give the soldier that perfect command of

[1] See Journal, vol. xxvi, No. CXVI.

his weapon so necessary to him under the changed conditions of war. Following, though independently, in the steps of Major Brooke, I strongly advocated the use of the Morris tube, or some equivalent of the same, as the only really practical means of getting what is required. I am glad to learn that by this time its introduction into the Navy has been definitively commenced, and that before long it will probably be in the hands of the Army also. From the results which have already been gained by its use, we may, I think, fairly reckon on its leading to a degree of expertness in the use of the rifle such as has never yet been obtained, and that one of the stock objections to a change of armament, viz., that our men already carry a gun which is far too good for them, will in future be less often cast in our teeth.

But we must not forget that if we are to gain these advantages, the Morris tube must be put to its proper uses under proper supervision and carefully framed instructions. If the contrary is to be the case, it will remain a mere toy, of little practical use, and likely to confer no substantial benefit; used as it should be, it becomes a scientific instrument of the highest value, and may be made to effect as striking a change in the quality of small-arm fire as was that initiated by the efforts of Hay and Wilford. This may sound like an exaggeration, but I do not believe it to be so, and I will explain my reasons. Of course I know from my own experience as a musketry instructor what the temptation will be, viz., to use the tube to get improved shooting at fixed targets, to help lame dogs over the stile, to push forward stupid recruits or incorrigible third-class shots, or give a finishing touch to the probable marksmen of the battalion, for which purpose any amount of ammunition will willingly be paid for by Officers or men. Pleasant little rifle matches at wafers on a wall, or what not, will be got up in rainy weather, and altogether the tube will make a certain general improvement in the ordinary range practices, and be a source of amusement into the bargain. But if this is all that comes of it, we shall not have made a single serious step in the direction in which progress is most urgently required—I mean that of *field* shooting as distinguished from *garrison* or *siege* shooting, which is mainly what we now devote ourselves to, that is to say, practice at fixed objects from fixed positions, as distinguished from the fire of moving men directed on men or horses, themselves also in motion. How many amongst our best shots can hit a rabbit running, with a rifle, put a ball through a bird on the wing, or even a hat thrown up in ever so easy a way? Not one in a hundred, and why? Not because the thing is either impossible or really very difficult, but partly because from our living in an inclosed and densely populated country, no one has or can have the means of practising these things. The eye is quick, the rifle true, the hand can be trained to anything, and the object five times, let us say, the size of the carton we should be ashamed to miss at 100 yards, and it is only 20 yards off. What, then, is the matter? It cannot be only want of practice that makes the man miss every time. Is it not mainly because the object moves, and that too quickly for the slowness and deliberation at which our

training stops short; a great deal too quickly for our instructions to get the eye well down to the bottom of the notch of the back sight and see the tip of the fore sight aligned with the centre of the object, to feel the butt is well pressed into the hollow of the shoulder, the breath held, and the trigger squeezed, till the rifle goes off, special care being taken not to wink with the right eye?

Not that all these things are not excellent and necessary things, but that they are only the spring drills, the extension motions and balance step without gaining ground, of rifle shooting as it should be, and sooner or later I feel sure will be, taught to the soldier.

His position in going into action as it is, is much that of a man who should be carefully put through aiming drill, position drill, and the rest of it, together with all his standing firings—with a double gun—and then be sent out after a jack snipe, under pain of death should he fail to kill it.

We take him as far as the stuffed partridge on the top of a pole; and when he has blown it to bits, we leave him to do his best in the turnips.

When I say this do not, I beg of you, suppose that I for a moment think that we can afford to neglect the goose-step, or that parade-marching is unnecessary, or that without both of them, and plenty of them too, we could approach our enemy with precision, or manœuvre with confidence in his presence.

What I want to express is my conviction that when we have trained our men at fixed targets only, and at regulated distances, we have got no further than the goose-step of rifle shooting, and have still all the rest to learn.

Do what we will, in action we must keep moving, and as a rule the enemy does the same. Thus the man who knows nothing but what he has learned on the ranges must inevitably waste his ammunition, and he does it too, to a degree which, but for reliable statistics, would be simply incredible.

We have, therefore, to take him a step further; up to the present time, for reasons before mentioned, it was impossible to do so in this country. But the Morris tube now, once for all, removes the difficulty, *i.e.*, it enables us to have plenty of the practice we want, and do it safely, and if we will only use it in the proper manner will enable us to complete the remaining steps of our training, which would be pretty much as follows:—When the man has been so far taught and practised that the movements of rifle, hand, and eye are made instinctively and naturally, and when he can make fairly certain of a fixed target, he should be taken to snap shooting, not haphazard at anything that moves, but first at disappearing targets, which will give him only a certain time in which to get his aim, and so teach him to get it quickly, and fire when he has got it. When he has learned this much, then let him be taught to fire at objects of the size and character and animated with the same speeds as those he is likely to encounter in war. Miniature targets should be devised, representing, for example, a horseman at the gallop at 100 yards, a battery at the trot at 1,000, a man running at 50, or a company in motion at 1,500,

or upwards, &c., and when the soldier is able to give a satisfactory account of such objects as these, and has really conquered the difficulty of firing at moving objects, then the more hats or halfpence he shoots at the better.

As I said before, without the tubes we could never have taken this step in advance at all; and if only now, when we have got them, they are kept for this their legitimate object we may with confidence look forward to an increase of efficiency in our infantry fire, the value of which it will be impossible to over-estimate.

At present no one seems to know much about the time of flight of the bullet at different distances which, when properly combined with a knowledge of the rates at which an enemy moves across the range, permits us to make such an allowance as will cause (as Colonel Wilford used to put it) the man and the bullet to arrive at the same spot, and at the same instant of time.

Nor would I burden the soldier's memory with such details as that the Martini bullet takes 1·46 seconds to go 500 yards, or 9 seconds to travel 2,000, but I would train his eye by moving targets of a carefully regulated size and speed to appreciate and remember the different allowances necessary, according to the appearance of the objects before him and their apparent motion.

Let us not imagine this is easy to do. Nothing worth having ever is easy, but I maintain that, although much opinion to the contrary has been strongly expressed, it is fully worth all the time and labour we could bestow on it. For I cannot believe that chance fire, *i.e.*, the fire of mere drill, can be as effective in the field as aimed fire, *i.e.*, the fire of drill combined with education.

I know that some good German authorities hold an opposite view, and assert that the mass of fire, and the time in which it is delivered, are the things to which regard is mainly to be paid; equivalent to saying that if only you let off enough guns where there are men about, sufficient accidents to answer your purpose will very probably occur.

We read that a certain man drew a bow at a venture and smote the King of Israel between the joints of the harness. That is to say, made the very best shot it was possible to make, and at the very man it was most desirable he should hit. But we should surely think it not a little remarkable were we to find that the drawing of bows at a venture had been recommended in consequence ever after.

Our own supremacy gained by the use of the same weapon at all events depended on the very opposite principle being inculcated, and what is true of one projectile weapon applies equally to all: with the exception of the Boers, we are now perhaps as a nation the best rifle shots in the world; surely, we should maintain this superiority by every means in our power.

By this time you will probably wonder what all this talk, true enough in its way, has to do with the special use of the repeater or magazine gun. It is this: we all have heard a broad distinction drawn, when speaking of the rate of fire of any weapon, between fire and aimed fire; for instance, in the case of the Martini we are told that

the gun has been fired by a single individual 30 times in a minute, that occasionally expert men with some practice can fire it from 22 to 23 times a minute, but that aimed fire can be carried on at but the rate of from 12 to 15 shots in the same time, and as I told you last year in some practice at moving targets only about 5 shots were got off. I have tried in several ways, while preparing this paper, to ascertain what the real rate of fire of the Martini-Henry is. Opinions vary, but I have every reason to believe that taking our men all round at fixed targets, and at 200 yards, its speed does not much exceed eight shots per minute, and at moving objects would be still slower.

Now all this *must* be wrong, these differences should not exist to this extent, and where are we to look for the remedy?

We may, I think, assume that the difference only depends in a small degree on the time taken to load, all men being drilled to do this in about the same time; depend upon it, it is on the time taken to aim in doing which the utmost deliberation is inculcated, and in which of course at fixed targets any amount of time may be freely taken.

What is the consequence? Here it is that all the delay takes place, and here at the fixed targets are manufactured what I called in my last lecture *poking* shots.

Who has not seen an unfortunate 3rd class victim come up to the targets wanting but a couple of points to get him out of his class? Who has not watched him set his teeth hard and aim till his legs trembled under him, and finally snatch at his trigger in sheer despair, and send his bullet to the moon, being immediately afterwards remanded, of course, to *aiming-drill* for the term of his natural leisure?

But all the man wanted was to be taught to catch his sights quickly, and fire as soon as he caught them, and he would have shot as well as any one. Nor is the mischief by any means confined to such men as these. I've seen dozens of so-called crack-shots (at fixed targets be it understood) dwell long enough on their aim to let a deer get a field off, or a partridge into the next county.

This deliberation is rightly enough inculcated in preliminary instruction, and the earlier firings at fixed objects, but it must not be allowed to form a habit than which none is more fatal to good field-shooting, and it is mainly to such exercises as these which I now advocate that I look for its eradication or correction. If I am right, the bearing of all that I have said is connected directly with the repeater question, for with the repeater the time of loading is reduced by at least one-half, and often much more than that. If now we are able by appropriate and careful training not only to make our men fair average shots at moving objects, but by the same operation reduce the time now uselessly occupied in a hesitating or over-deliberate aim, we shall at once reap the full value of the new weapons without further trouble, increasing the weight of fire thrown in a given time to a degree satisfactory to the German theorists, and improving its value in accuracy sufficiently to fulfil our own requirements.

So far for our own preparation for a change, and what still remains to be done: let us now proceed to inquire what our neighbours have been about, and I will then examine into the magazine-gun question somewhat further, and consider, so far as *a layman* may, the various points we should look to as guides in the selection of a suitable repeater for military purposes.

So far as I am able to learn, the whole question is still in an experimental stage, more or less advanced towards decision in the various countries of Europe.

In France the adoption of such a weapon is at this moment under serious consideration, for although, as you know, the marine corps are already supplied with the Kropatchek in large numbers (some 30,000), this weapon is considered in several ways unsuitable for troops of the line, and a Committee is at this moment sitting in Paris, before which almost every known form of repeater has been brought for consideration.

At St. Petersburg a Committee has been formed, or is shortly about to be so, although (as, perhaps, you know) the Russian Navy already carries large numbers of the Evans repeater, the butt of which contains somewhere about thirty-five cartridges, or seven more than the average number expended by the Prussian army in the whole of the Austro-Prussian campaign.

Spain has selected three types of gun for further trial.

Austria is experimenting with an extremely small-bored rifle, and has examined and reported on the Schulhof (see Plate, Fig. 2), Mannlicher (Fig. 3), and several other systems.

Sweden is dallying with the Jarman gun, and the Norwegian Navy carry the Crag-Petersen.

Italy has a repeater, I believe the Vetterli, in some numbers in her fleet, but is looking for something better for both it and her land service, and having got her credit, will probably soon come to a decision.

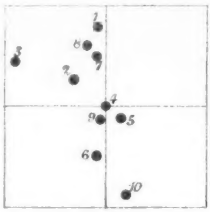
Switzerland is at last dissatisfied with the Vetterli, and wants something new, and Turkey, as of course you know, has a large number of Winchesters.

But of all the European Powers, Germany has taken the most decided and practical step, having ordered 2,000 Mauser repeaters, which she has distributed 500 to each of four regiments, selected from the different nationalities of the Empire, and awaits their experiments and reports before taking further action.

America shows no less common sense; she has ordered after exhaustive trials of all the systems presented to her, a certain number of each of the four which finally came out highest, but as yet the orders, so far as I know, are not completed. Of other States I have at present little or no information save that this much is certain, no one Power in Europe can afford, or will dare, to be behind-hand in this matter when once the others have commenced arming with the new weapons, and all seeming hesitation will give place to serious activity so soon as any one of the great Powers shall have definitively taken the matter in hand.

DIAGRAM OF 500 Yds TARGET MADE AT ENFIELD JUNE 1st 1883.
WITH NEW 400 BORE ENFIELD MARTINI RIFLE.

Fig. 1.



N.B. N° 3 shot was carried to the left by a puff of wind

Vertical dimension of group 9 inches.
Horizontal ——— 4 ———

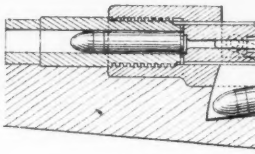


Fig. 4.

SPENCER LEE MAGAZINE GUN.

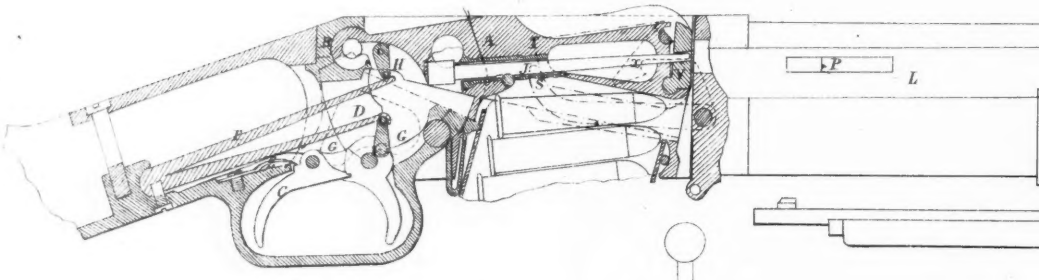


Fig. 3.

MANNLICHER REPEATER

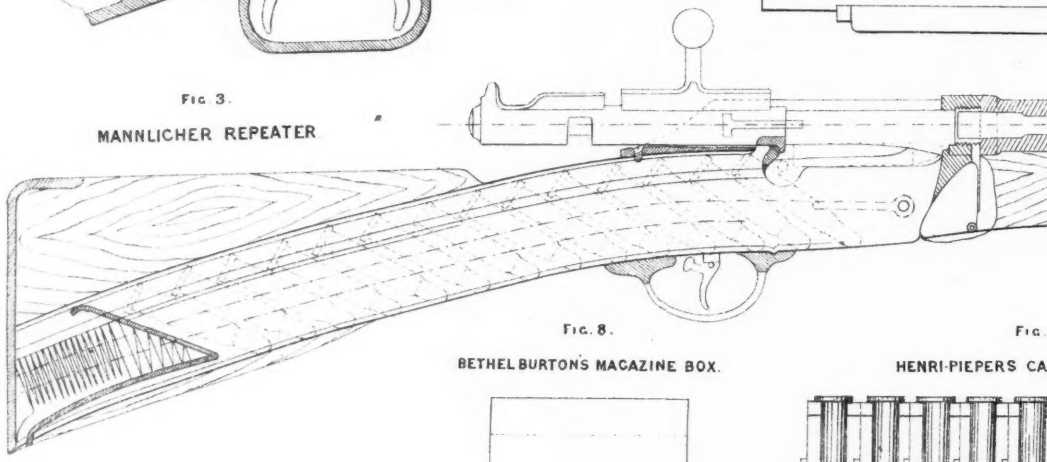
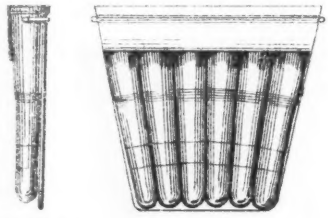


Fig. 8.

BETHEL BURTON'S MAGAZINE BOX.

Fig. 6.

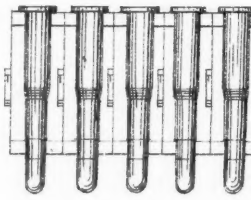
COL FOSBERY'S CARTRIDGE HOLDER



Side view. *Front view.*

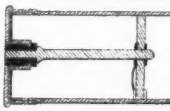
Fig.

HENRI-PIEPERS CA



Fig

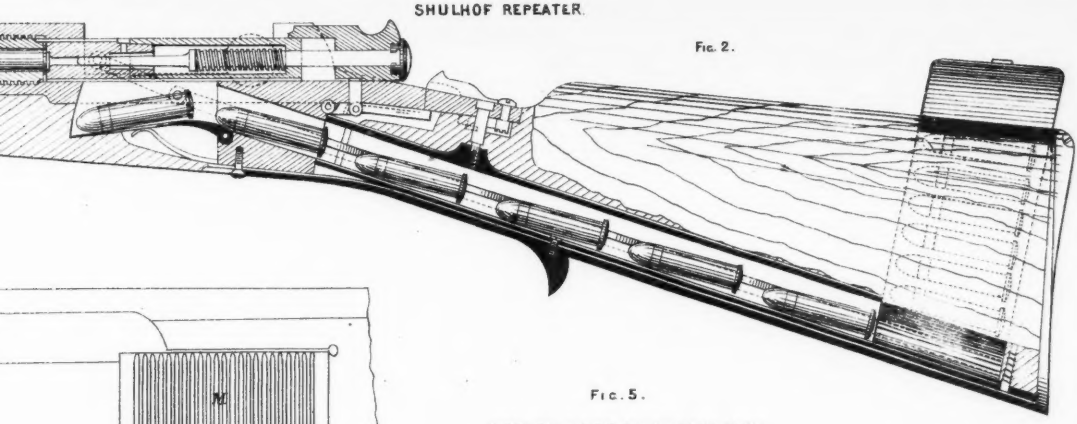
PIEPERS ELECT



Harrison & Sons, Lith., St Mar

SHULHOF REPEATER.

Fig. 2.



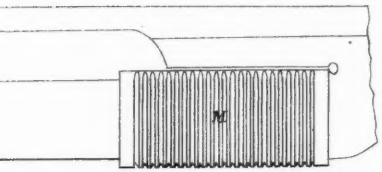


Fig. 5.

DEELEY EDGE MAGAZINE GUN

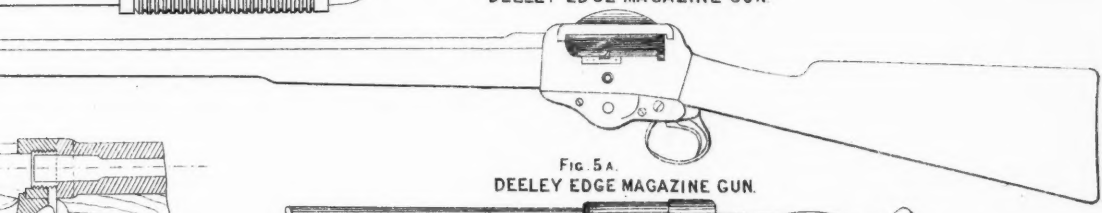
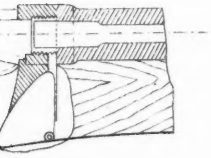


Fig. 5A.

DEELEY EDGE MAGAZINE GUN.



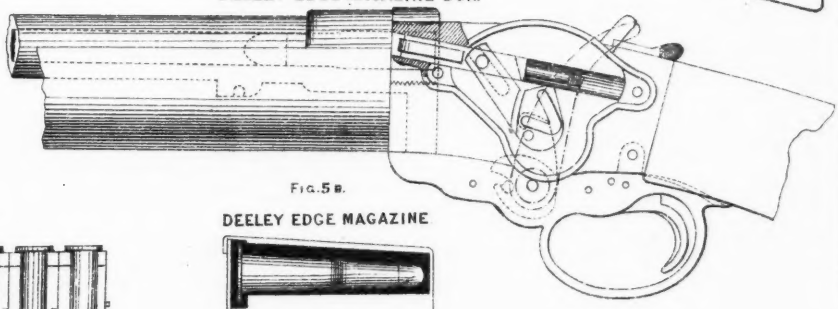


Fig. 9.

NRI-PIEPERS CARTRIDGE CHAIN.

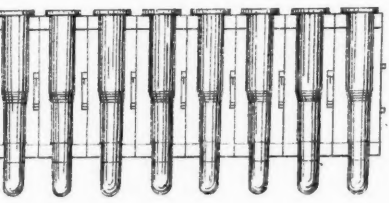


Fig. 10.

PIEPERS ELECTRIC CARTRIDGE.

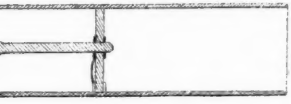
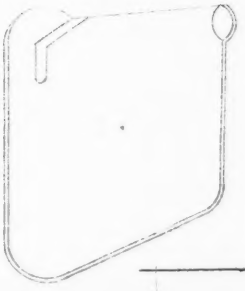


Fig. 5B.

DEELEY EDGE MAGAZINE

Fig. 7.

LEE MAGAZINE.



...son & Sons, Lith., 57 Martins Lane W.C.

As for ourselves, it was thought, I remember, at the time of my last lecture, an unfavourable symptom that a new type of Martini of small bore should have been introduced and experimentally issued in small numbers to our School of Musketry, training-ships, and some few regiments of the Guards, and others. This, however, was by no means the case, and the experiment has been used to settle approximately many questions of bore, barrel, and cartridge, all of which required careful consideration and no inconsiderable experience before the most suitable conditions could be selected for the weapon of the future. So far have these trials been carried, that the bore, the rifling, the weights of lead and powder, and some other details of wad and lubrication, may be said to have been definitively fixed; and to judge from a target of ten shots made at Enfield last week, in which every shot at 500 yards was included in a parallelogram of 9 inches by 4, it would seem that there can be very little more to be desired. (See Plate, Fig. 1.)

The cartridge question (always a most difficult one), was in old times settled solely with reference to the requirement of breech-loading small-arms; it must not be forgotten, however, that the machine-guns already issued to the Services now control its length, and that even its diameter and form may have to be modified, in order to make it pack symmetrically and easily in the magazine selected for the new weapon, whatever that may be. Side by side with these experiments, which have been most thorough and exhaustive, a Committee has been at work on the magazine-gun also, and will probably have concluded its experiments and be prepared to make a final report by the end of the present year. Thus it will be seen that no time has been lost—that a most important part of the inquiry is all but terminated, and we may congratulate ourselves on being in these matters fairly abreast of our neighbours, or at least in such a position that no one of them, were they to make the attempt, could get far ahead of us in this matter of re-armament.

We may feel sure that the Magazine Arms Committee has by this time eliminated many of the systems which have been so largely championed by sanguine inventors or half-informed amateurs, and that many a gun is already weighed in their scientific balance and found wanting.

But, if this be the case, it is equally certain that the Committee is bound to recommend as well as to condemn; and should no one invention fully satisfy their every requirement, to construct and combine also, so as to obtain the most perfect weapon possible for the country.

Now this is a process which is eminently distasteful to the individual inventor, and I have heard the strongest language made use of in its condemnation. A little thought, however, will show us that under most circumstances it is allowable, and under many a matter of absolute necessity. As a matter of course the necessities of the State must override individual interests or susceptibilities where the two are brought into conflict, and that they generally will do so in cases such as this, is equally certain. No man, as a rule, can be the sole

possessor of all the best ideas or contrivances to attain a given object, and many inventors are compelled to make use of inferior combinations to avoid trespassing on the domains of others.

Thus, in this very case of magazine arms, one will have a perfect bolt or lock combined with an inferior magazine or a faulty extractor; in another the magazine will be all that is desired, but the firing mechanism weak or preposterous; and so on through the various parts which go to make up the weapon.

Under such circumstances, I hold that a Committee which would fail to make the best possible combination from the different parts brought before it would signally fail in its duty. And so long as the author of any important element adopted is justly and honestly credited with his proper share of the whole and proportionably rewarded, I fail to perceive that he has much cause for complaint.

This, of course, renders it more probable that with the large number of weapons now in the country, many of them of singular merit, some magazine arm, either simple or cross-bred, may ere long be produced to challenge our criticism or command our favourable verdict. Anyhow, it is safe to say that the days of the single-loader are now at last fairly numbered, which is a good deal more than could have been asserted with any degree of confidence at this time last year; and to us who believe in the great future of repeaters this is very encouraging.

At that time, as you will remember, there were far fewer repeaters known to the world than there are now, and our consideration was limited to a very short list, mostly composed of old and well-tried inventions, or to a few details of some one or two of the newer systems then just coming into notice.

The case is now different, certain conclusions as to many of them have been arrived at, and new methods of cartridge arrangement and supply have been devised and perfected, which from their very nature put older and less effective ideas wholly out of date.

Thus, in considering the magazine arms of to-day, I may, I think, finally dispose of and exclude from my category all such as contain a column of cartridges in a tube, and actuate them by a spiral spring, whether the tube be placed under the barrel or in the stock. We thus dispose of all such guns as the Winchester, the Mauser, the Kropatchek, the Hotchkiss, the Ball Lampson, Spencer, Vetterli, and a host of others, *quos enumerare longum*, the reason for this exclusion being the possible danger and the certain inconvenience of the arrangement; such guns being amongst other things slow and troublesome to load, and whether or no they risk exploding their magazines, always more or less damage their bullets, and injure their powder by the jolting and compression to which the cartridges are subject in the tubes. This preliminary weeding out, rough as it is, is yet I am sure reliable, and vastly simplifies the task of examining the weapons amongst which the probable rifle of the future, or perhaps I should say the principles on which the rifle of the future will be constructed, may be expected to be found. For once the spring tube under the barrel or the spring tube in the stock are discarded, we

have but two or three places in which to carry our supply of ammunition, and but one or two methods of arranging it there.

For instance, we may place our cartridges vertically in a single row, one above the other, or diagonally as in the Mannlicher rifle (see Plate), or again in a tube if only they are separated by the mechanism which brings them up to their work, instead of being placed in contact and driven by a spring. Then the vertical box may be placed on the side of the gun wholly above the axis of the barrel as in the McEvoy Mannlicher and some others, under the centre and wholly below the axis as in the Spencer-Lee and another form of the Mannlicher; or again partly above and partly below as in the Bethel Burton gun, the Perry quick-loader, my own attachable magazine (Fig. 4), and a new rifle by Deeley Edge (Fig. 5), which I have not yet seen in its completed form; or on the other hand, the vertical box may be placed in the butt as in the Schulhof, the cartridges being brought up separately by simple ratchet mechanism, through such a tube as is employed in the Chaffey-Reece, or again the Chaffey-Reece's tube may be employed alone as in the weapon of that name; in this case, however, it has the serious disadvantage of being slow to load, and moreover being capable of containing but very few cartridges.

The diagonal butt tube of Mannlicher is the only other way in which to my knowledge cartridges can be stowed conveniently in the stock, and here the supply is ample, and though the inconveniences of loading are now the same as those attaching more or less to all tube guns, this admits of a remedy. In this connection I cannot help, notwithstanding all I have seen and heard since last year, adhering very thoroughly to the opinion I then expressed, that a magazine gun to make it worth our while to adopt it, should contain at least ten cartridges; with this number every ordinary contingency of war requiring the use of the magazine could confidently be encountered, with less, I do not hesitate to say no consideration of mere sightliness or convenience should induce us to be satisfied—unless indeed for a gun containing a smaller number, some method of loading *en bloc* should be discovered. I will admit that the problem is a difficult one, and one satisfactorily solved in no gun I know of with the exception of the Bethel Burton which I brought to your notice last year. But it is certain that, should the magazine gun be finally adopted, the present method of carrying our cartridges must be abandoned, unless we desire to content ourselves with a weapon far less really serviceable than it can be made by this means. I do not propose to recommend any particular way of doing this, but you can see for yourselves the inconvenience of the present method; watch for instance the preparations necessary before making a range trial of any of the magazine guns you know. First the cartridge packets in sufficient number are laid out on a table, then they are untied and opened out; then the cartridges are carefully arranged with the heads one way and the tails another, and finally they are picked up one by one and either forced through a trap in the stock, pressed against a spring into a box, or dropped singly into a grooved receptacle somewhere about the gun.

This is all very well, and in the hands of the experts who generally show off these weapons, looks easy and simple enough, and once the firing begins one is apt to be too much astonished at the effects of the repeater in any form to be too critical about preliminaries. Let us, however, change the *personnel* and surroundings a little and see what will happen.

Let us take away the table and put the rifle into the hands of A.B. John Evans of Her Majesty's Navy, and leave him to recharge his magazine in the top of his ship in a blow of wind, or sitting on the thwart of a cutter in a sea-way with wet fingers, the spray flying about his ears, and the motion of the boat making him wish he had an extra hand to hold on by; or, again, button up Thomas Atkins in his great coat, put him on duty in a trench half full of snow on a dark night, freeze him hard enough, and then tell him to load his magazine arm and do the best he can with it.

These are but simple examples of circumstances under which the magazine arm may have to be used at any time by our soldiers and sailors, and therefore it is that I so heartily concur with Admiral Boys in a remark he made last year in this theatre, that for any magazine or quick-loader it is desirable that the cartridge should be issued in the contrivance to be employed. For this reason such guns as the Lee and Lee-Spencer, which have partly solved this difficulty, possess to some minds an advantage above other systems which involve an adherence to the old plan.

Bethel Burton has gone still further in this direction, and has to my mind produced a still more satisfactory solution of this question. But other inventions are in the field, and it is certain that no magazine arm can attain the highest excellence which does not in some way deal also with the question of cartridge carrying and cartridge packing, as well as that of a mechanical supply in the arm itself, and reliable contrivances for support, firing, and extraction.

You will observe that some of the inventions which I have mentioned relate to magazine arms proper, and others to weapons provided with an attachable magazine. It is right, I think, here to point out that what is called the attachable magazine is not one exclusively applied to existing arms, as is commonly supposed, by way of converting them into repeaters, but that when this is done it is only as a matter of convenience or economy, and, like all conversions, at best a compromise. The attachable magazine in its best form is used with a rifle constructed specially for it, which also forms an efficient single-loader when the magazine is detached.

The earliest, and by some even now considered the best weapon of this kind, is the Lee rifle, which has been for several years before the authorities in this country, the Lee magazine (Fig. 7) being also used in the Spencer-Lee rifle. Mannlicher places his diagonal magazine—an admirable invention—in the same position, and has constructed a special rifle to carry it as he has also done in the case of his diagonal overhead magazine.

In treating as I propose to do of the considerations which will probably guide us in the selection of a repeating arm, it will be

understood that when an attachable magazine is referred to it will be an attachable magazine, for which a special rifle will be required. Indeed, I think a useful distinction in our nomenclature might be made did we call such rifles as carry a detachable magazine, Magazine Guns, and those which contain their supply in the butt, Repeaters.

It is clear that each of these classes must have its peculiar advantages and also its drawbacks, and it may be useful to begin by considering them before dealing with other questions.

Indispensable as the magazine gun or the repeater will prove itself to be, and overwhelming as will be the advantages which it will confer on such troops as shall not only possess it, but be carefully and systematically trained to its use, we must not lose sight of the fact that, even in war, the occasions for their use will not be of everyday occurrence, though they may at any moment occur; furthermore, that troops will as a rule be able to foresee the need of them, so as to have time to fix their magazines in case they should require them, thus placing repeater and magazine guns in so far on a par with each other.

In time of peace or for ordinary duties, except practice, the magazine will never be required at all. That is to say, supposing that a soldier be so fortunate as to be campaigning during a twentieth part of his period of service, he will probably use his magazine only during a twentieth portion of that twentieth, or, roughly speaking, during the four-hundredth part of the time he carries a rifle, and for the 399 remaining portions of his time he must carry—or rather must he carry, clean, and keep in order, and must *we* pay for, a heavier, more delicate, more complicated, and more expensive gun than that at present in use, in order that at some period of his life he may successfully storm or defend a position, neither of which things could be done without it? As one proof of its necessity, it is hardly necessary to remind you that since I last dealt with this subject we have witnessed one of those brilliant operations of war the success or failure of which turned entirely on the question of the value of infantry fire as delivered from an intrenched position; that is to say, under exceptionally favourable conditions.

One hardly knows which to admire most, the daring of the conception or the profound calculation of comparative values which led to the night march on Tel-el-Kebir and the storm of that position with the bayonet.

I have heard the outburst of rifle fire from the works when the alarm was once given described as having been something awe-inspiring and terrible, and yet results showed that, as Lord Wolseley had calculated, it was practicable to push on in the face of it.

Can any one who has seen magazine arms used believe that success could have been gained in the teeth of such weapons had the Egyptians carried them and used them with coolness and determination?

I for one am unable to think so, nor do I believe that had the enemy been known to have been so armed, the attempt would ever have been made. Of course it is ill limiting the courage and dash of

British troops when led as they then were, but with all that, there are such things as physical impossibilities, one of which will be found to be the capture by an attack *en face* of any position which shall be adequately defended by troops armed with the repeating rifle; and yet such a defence may have to be made by any people, in any war, at any moment, and on its conduct may turn the issue of a battle, nay, even the fate of a nation.

It is clear, then, if this be so that, in some form or other, the repeater or the magazine-gun must form part of our armament, even though the average soldier will perhaps only need it during one four-hundredth part of his time.

This consideration would incline us at first sight to reject the repeater, and will probably decide some nations to do so.

On the other hand, we must not forget that it has many and great advantages over most forms of magazine-gun.

In the first place it is far more compact when any large number of cartridges are carried.

Then for passing through jungle and in many situations an attachable magazine, if an overhead one, would be almost impossible; as also would be the case for cavalry or mounted infantry in situations where the magazine would have to be kept fixed, and for such troops again a repeater would be preferable.

It is different when the magazine is placed on the side of the gun, but even this is not always convenient; besides which it must not be forgotten than any weight added to a rifle *unsymmetrically*, *i.e.*, to one side and above or below the axis of the gun, will have a tendency to throw the bullet out of line, and were the weight to remain always the same would necessitate an alteration in the position of the zero point of the elevating sight; now as an attachable magazine never remains of the same weight for two consecutive shots, we thus introduce a variable source of error, and one for which it is impossible to compensate.

It is different when, as in the Lee, the Schulhof, and one form of the Mannlicher, the magazine is placed symmetrically and underneath the action of the gun. There the error is one of elevation alone, and is one which has been already partially compensated for in the original placing of the zero point. Mr. Bethel Burton on his part, however, has reduced any error possible from the position of his magazine to so narrow a margin, by his distribution of weights, as to make it practically, perhaps, hardly worth consideration.

I am, however, fully convinced that unless we shall adopt one of the systems or strike out for ourselves a system in which the packages in which our cartridges are carried can be placed entire in the reservoir or magazine of the weapon, and fired from thence in proper succession without more ado, our choice, whatever it may be, cannot be a final one.

Filling the magazine through a trap in the butt, or putting cartridges into the top of a box, one by one, is a process which needlessly wastes time, and as I have said before, one not at all adapted to all the exigencies of war, either by sea or land. In fact, we must

begin at the very beginning; the cartridges must be so packed as to be capable of being loaded *en bloc* into our gun as easily and quickly as a single cartridge is now pushed into such places as the Winchester tube, or the Lee magazine.

Once, however, we admit this principle we find, I think, our choice of systems narrowed down to a very small number indeed.

The Lee and Lee-Spencer guns, it is true, attempt a solution, but it is but an imperfect one, viz., the Lee magazine (Fig. 7). You cannot expect that any Government will consent to pack its rifle cartridges by fives in steel boxes of inconvenient shape which, in addition contain movable plates, and steel springs, studs and catches, and would neither stand sea air nor Indian magazines for a year, and remain serviceable, to say nothing of their first cost. Nor, I think, should we call on our soldiers or sailors to carry less cartridges and more useless metal than necessary, besides which we should not give them in addition to other things a lot of little boxes, which, in the heat of action, they must carefully put back in their pockets when empty.

The Mannlicher has, though in a less degree, the same disadvantage. The boxes take time to fill when once emptied; they are too expensive to admit of being thrown away, and none of them hold ten rounds.

The only rifles which are now in existence, and which have in any satisfactory way met this difficulty, are the Deeley Edge, which has a tin box with ten cartridges, but still contains a spring (Fig. 5, *b*), the Bethel Burton,[1] which does not (Fig. 8), and is in so far more satisfactory, both of which place their magazines on the side of the gun, and the Schulhof, which carries its box of cartridges in a trap in the stock (Fig. 2).

They say, indeed, that in this gun the wood of the stock is dangerously cut away, and far too liable to be split or damaged.

But why, may I ask, should there be such a thing as wood in the stock at all, to be cut away for this or for any other purpose, when stocks could be made so much better, stronger, and cheaper out of other materials, with all the necessary openings or hollows ready formed in them, instead of our having to cut down all the walnut-trees in Italy, and then by delicate and costly machinery form the timber into gun-stocks liable to split? Have we not to hand materials far more suitable which admit of being formed in a press to the requisite shape at a single blow? Metal, papier-maché, compressed wood, or half-a-dozen other substances might be treated in this way, but the necessary machinery could only be set up by the State, or by some large firm of manufacturers capable of bringing such a process to perfection, and willing to spend the time and the money necessary for the purpose; it is wholly out of the reach of any private individual.

Once done we should hear no more of want of room for our cartridges or of split or weakened stocks.

[1] The Bethel Burton magazine is placed partly beside and partly within the action of his rifle, and distributes the weight far better than any magazine on a similar plan; his bolt and general arrangement besides is admirable.

The stocks, too, would necessarily then be hollow, and the space thus gained could not possibly be better employed than by making a magazine of it, as Schulhof does.

Look at the outline of a gun, and the works which fill every part of it; here and here alone there is nothing but useless wood, and of course here the eye and common sense alike say should be your magazine, unless, indeed, you happen to prefer an excrescence as a matter of taste.

I have neither the time, nor had I that, the information that would be required, to give you a *résumé* of all that has been done in the way of the mechanism which more directly relates to the firing and extraction of the cartridges of these arms.

There seems to have been a very general abandonment, except in the case of the new Deeley Edge, of all systems but the bolt, and a tendency to simplify and improve the bolt, while making it secure against any possible risk of premature explosion.

Of bolt-guns, moreover, perhaps the Lee, Mannlicher, and the Bethel Burton are, as single-loaders, the most simple and efficient, and best adapted for use with the magazine. Should a compound or cross-bred gun be adopted, one of these three bolt-guns would probably be found suitable enough.

For carrying the cartridges we must remember that, however we make our package, it must be adapted for use with the single-loader as well as with the magazine; and for the machine-gun, in a less degree, as well as with either, and that it should be for these purposes of metal and not of paper or cardboard.

I have myself given some attention to this question, and this is the result (see Plate, Fig. 6); perhaps only an attempt at a solution, but at all events an attempt.

This is another, and far more elaborate one—the production of my friend M. Pieper, of Liège—which, as you see, might be fed into a gun of the simplest construction, and do away with magazines altogether (Fig. 9).

This is Mr. Burton's box; and, indeed, there are a dozen other ways of doing the same thing, *i.e.*, dividing the magazine-gun problem into two parts—the cartridge package and the magazine proper—and making the two work together harmoniously and simply in the gun.

On the correct solution of this question turns the entire future of magazine arms.[1] I can only hope that in saying so I am not on the one hand guilty of presumption, or on the other of contempt of court in thus treating of a subject still *sub judice* in every country in Europe.

Before concluding, I will, if you will permit me, show you what is as yet but an infant but still a well-grown and capable infant, and one that may well develop into a powerful and formidable man; and this is the electric gun of M. Pieper, of Liège. The details by which the current is produced or conveyed to the cartridge may be modified, and

[1] I should not, however, omit to state that in my opinion no mechanism will prove satisfactory which does not permit the magazine to be emptied *conveniently and rapidly* without removing the rifle from the shoulder.—G. V. F.

the source of electricity be carried in the gun itself instead of on the person of the firer. But the cartridge (Fig. 10) it would, I think, be impossible to simplify or improve; and, once we admit such a thing as possible, see the advantages which we obtain.

First, we do away with all the appliances for delivering a central blow on the cartridge, and have all the space which they now occupy for our magazine or other means of loading. Then, having no fulminate in the cartridges, we can carry and arrange them how we please; and, igniting the powder in front, we are enabled to get higher velocities with lower charges—a great desideratum. In machine-guns such as the new Gatling of Mr. George Accles, which fires 104 rounds in 2·4 seconds, and now necessitates the compression and release of 14-lb. springs so many times in that period, imagine the saving of labour which would result from the adoption of a system which required only the making and breaking of electrical contacts instead, and the saving of wear and tear which would result. But, as I said before, the thing is still in its infancy, and for these and other purposes is yet awaiting development. M. Pieper is already manufacturing these arms in the form which you see, and so far they are perfectly satisfactory—one great advantage being their immunity from danger of accidental explosion when out of the shooter's hands.

Here, again, is another weapon, also of Belgian origin. The Fusil Nagant, which contains several valuable novelties in the side sight for long-range shooting—the method in which the fore-end is attached to the barrel so as not to effect its accuracy, the stud for the sword-bayonet, and the ramrod tube, &c. It is, as you see, a small bore of ·40 diameter; and Captain Guillaumôt, in the "Revue Militaire Belge," speaks most highly of its performances both as to range, accuracy, and all the qualities we demand from a first-class weapon.

Its chief feature is, however, its admirable breech-mechanism, which for strength, simplicity, and the ease with which it may be dismounted, stands far before that of any single-loader with which I am acquainted. So rapid is its action, that Captain Guillaumôt goes so far as to say that its adoption would enable his Government to dispense with any form of repeater.

Major FERGUSSON (Rifle Brigade): My lords and gentlemen, I hope an unmounted Major who has never seen active service will not be accused of presumption in joining in this discussion. We have heard a very interesting lecture, and I should like to address myself to one or two points referred to by Colonel Fosbery. I was very glad to hear him speak well of field firing. I have just returned from three years' service in South Australia, where I have been a sort of Brigade Major, Adjutant, and Musketry Instructor rolled into one, and we did a great deal of field firing, very much more than is attempted in the Army. I cannot help thinking any changes in the direction of more field firing will be very wise. We used to take ten men per company out at a time and practise them in field firing and so on, till the majority of the men in all the companies had had a turn at it. We practised them in firing at unknown distances, now doubling, now advancing in quick time, now retiring, and so on. With reference to the Morris tube, it seems to me that no provision has been made for an enemy coming to you or going from you. We have been shown diagrams of the enemy crossing the field of view, but I take

it in action, the enemy is generally either coming or going, and not crossing. I should like to know whether the tubes are used also in practice accustoming men to firing at an enemy advancing and retiring. Then, again, about the time of flight, Colonel Fosbery recommends that men should be instructed in allowing for the time of flight of the bullet. Well, think what remarkably intelligent men you would require for that sort of additional practice and instruction! Would there be time to teach men that sort of thing, and is it necessary? Those of us who are accustomed to shoot grouse and partridges driving do not know anything about the time of flight of the shot, but we know by practice how much to allow in front of the bird, and so it would be with rifles. If men only got enough practice at field firing and at moving objects, there would be no necessity for giving them instruction in times of flight. Colonel Fosbery mentioned the Boers, and he hazarded the opinion that the Boers were the only people who are better shots than ourselves. Well, I do not believe the Boers are all such marvellous shots. I believe that Majuba Hill was lost because the men forgot that they were firing down a steep hill. The company Officers I am afraid forgot to tell the men that they must put their sights as low as they could, and even then fire low. We were told that the men were found lying dead with their rifles sighted at 400 yards. Of course, if you are firing down a steep hill you cannot put your sight down low enough. If any of you have practised at birds firing down a precipice, you know you must fire a long way below the bird. I believe if the men had only been cautioned in firing at the Boers coming up the hill to put their sights as low as they could, Sir George Colley, whom I well knew—the unfailing friend, the distinguished scholar, the brave soldier—would not have been lost to the British Army. I quite agree that a slow aim is not always the best. It is a very good thing for a man to learn to take aim quickly, but I must say I think the danger is not too slow firing in action, but too rapid firing. I speak with great submission, not having had experience in the field, but I have always understood the great thing was to try and get the men to fire slow. In the peace manœuvres at Aldershot I always found after a brush with the enemy the young soldiers had used up all their cartridges, but the knowing old soldiers had a good many left. If we are to inculcate rapid firing as the great *desideratum*, I think we shall do a great deal of mischief. How are you going to carry cartridges enough? We have been shown some very ingenious and clever contrivances for carrying cartridges, but how about the weight and the transport of this ammunition? I think Colonel Fosbery is a little too hard on the present system of instruction, especially with the modifications which are now introduced. I do not believe the mischief is done at the rifle range, but it is done at field days. The men are not sufficiently kept in order, there is no fire discipline; the men are allowed to fire without adjusting sights and without aim. They very often do not know what the objects of the manœuvres are, and perhaps you can hardly wonder that they treat the whole thing as if it was more or less nonsense. If they were made to consider it a point of honour always to take aim at something and to adjust the sight for every shot, then it would become a mechanical matter, and when they come into active service in the field they would not forget these particular things. I cannot believe that a repeating rifle is an arm to put into the hands of the recruit. It may be a good arm for the Navy, or for defending a fort or a field work. Perhaps a few picked marksmen of the regiment may be entrusted with repeating rifles, but I do hope that nothing rash will be done in the way of arming the whole British Army with repeating rifles. The Germans are going in the opposite direction; they are trying to simplify their arms as much as possible. I read the other day that an improved Mauser is being adopted in which the lock only consists of three pieces, very much less complicated than the old Mauser. That is the direction in which any changes in the British rifle ought to be made—to simplify the rifle as much as you can—because you must remember that your material is very raw, and even your old soldiers are uncommonly young men.

The Earl of Wemyss: I regret very much that I have to go to another place to vote on a rather important question very soon, and therefore if you will allow me I will ask Sir Beauchamp Walker to take the chair in my place. Before doing so I should like to express my own thanks to Colonel Fosbery for the

very interesting lecture which he has given us. The last speaker thinks it is desirable to simplify the Martini-Henry, and not to have a magazine or repeater. Now I, for my part, am inclined to think that the feeling is growing that it is necessary to have something more than the ordinary rifle, and no further proof need be asked than the fact stated by Colonel Fosbery that every other nation in the world at the present moment is considering this question. I hear for instance that the Germans have ordered one thousand repeaters, and I am glad to see by the "Times" of this morning that Mr. Brand, who has charge of these things for the Government, announced last night that they were going to take a vote for a thousand in order to test this experimentally. I think there may be occasions when troops armed with the ordinary breech-loader opposed to troops armed with the magazine or repeater would be simply in the position in which the old muzzle-loader was when opposed to the breech-loader. I think that is indisputable, and there may be occasions when it would be necessary that they should fire very rapidly. As to the question what form it should take I think the ammunition ought to be self-contained with a view to simplification, for if not the magazine may not be to hand at the time that it is wanted. It seems to me to make all the difference whether it is self-contained, and that the repeater if you can get a good simple one without complication is the right way of having a rapidly firing arm. The Schulhof rifle seems to be as nearly perfection as possible. It opens in the stock: there is no spring in the mechanism, and the cartridges are all carried in a carton case which can afterwards be thrown away, and of which the man can carry two or three with the greatest convenience by the help of which the repeater can be loaded with great rapidity. This rifle when brought to my notice last year seemed so good and so simple that I ventured to write to Mr. Childers about it, calling his attention to what appeared to me to be a very simple and effective arm. I have seen nothing myself that appears preferable, and I am glad to find that Colonel Fosbery, having gone into the matter so thoroughly, seems to think that it is one well deserving the attention of this very appreciative audience. As regards field firing, there is no doubt that a man ought to be able to shoot in every possible way, in any position, and at every sort of object, but I own myself, having had a great deal of experience as a sportsman in the Highlands, in firing at things moving, judging distances and so forth, I should not have thought it possible that you could get every soldier in the Army to be trained up to what a deerstalker, after much experience, finds it very difficult to do, to be able to judge distances to shoot with any degree of accuracy at men moving across or in any direction even at 100 or 300 yards. My own conviction is this, that skirmishing in small sections under a section leader, that section leader being a thoroughly competent man-stalker, is the only sound and practical system, and the one which will be found to give the most effective force in the field. If you had your men firing by word of command under the section leaders, I cannot help thinking in that respect you might possibly improve upon the general system, though you might not make every soldier in a regiment 600 strong a manstalker. I have only to add I have no doubt that the electric gun has a great future before it, that it is an infant Hercules in very small compass; but I think, seeing that Colonel Fosbery had to attach to his person a lightning conductor, and, seeing how possible it is in scrambling through brambles and woods that your conductor might get out of place, people will be very cautious before they adopt these infants! It may very likely succeed in the future, but it would be very awkward if, instead of hitting the object you aimed at, you found yourself unexpectedly blown up.

Colonel Sir LUMLEY GRAHAM: I had the pleasure of hearing Colonel Fosbery's lecture last year, a most interesting and instructive one, in which he gave us a very complete account of all the magazine arms and repeating arms then projected, and he has added to our information by his lecture to-day. I may remark perhaps, before saying anything further, that it has come to my knowledge that the Austrian *gendarmes* and the Tyrolese mounted rifles are armed with a repeater, which they call the Frukwirth. I have no particulars about it, except that it fires eight shots, but as the Austrian Government has armed its *gendarmes* and its Tyrolese riflemen with it, I suppose it is reckoned of some value. I wish to make some few remarks upon the first part of the subject—the general question—more the tactical question

than the technical question. I fully concur with all that Colonel Fosbery said about the necessity of extending our system of musketry instruction, and this happily our authorities have already determined to do. They have given a large extra allowance of ammunition, and they are also going to extend very much the system of field firing, which is a most important thing: for, as Colonel Fosbery remarked, hitherto, though we have had a very careful course of target practice, we can only look upon that as the preliminary instruction, just as the goose-step is the preliminary instruction for manœuvring. We have not got beyond the goose-step in firing as yet; I believe we have done our goose-step better than any other nation, but unfortunately we have stopped short there, while other nations have been going on to more practical work. Now we have seen the error of our ways, and we are going to embark in earnest in this system of field firing, which was introduced two or three years ago, but in a very mild form. There is one great difficulty connected with that—the difficulty about ranges, for unless you can get good and proper ranges you cannot have proper field-firing. With regard to the Morris tube, no doubt that, or some other thing of the same sort, is a most excellent part of the preliminary training of our soldiers; it will add very much to the interest of the thing, and no doubt conduce to make them better target-shots than now. I think Major Fergusson did not quite understand the Morris tube. It is not applicable to field firing at moving objects—at any rate it has not been hitherto applied to that—but it is meant to be used in the barrack-rooms or the barrack-square or quarters, as it is used in the German and other armies. Then, with regard to firing at moving objects, as Major Fergusson said, there is one thing that is forgotten, I believe, by all nations. I do not think in any system of musketry instruction the practice is carried out of firing at an advancing or receding enemy; yet that might be arranged by mechanical means. It seems to be a very important thing, particularly firing at an advancing enemy, because you are much more apt to miss a man coming at you than a man going away from you, and practice at an advancing object would lead to the aiming low which is always so important. I think Colonel Fosbery hardly did justice to those German authorities to whom he alluded, for he seemed to think that they considered aimed fire a matter of no importance. I do not gather that from what I have read and heard. I have read a good many of their books and have heard them talk a good deal upon this subject. I believe their feeling to be that great amount of fire in battle is of more importance than actual individual skill, and that fire discipline, in other words, the control the Officers have over the fire of the men, is perhaps of more importance than anything else, at the same time they do not undervalue skill in shooting. I do not think that it is their aim to make all their men good shots, even snap-shots. I think they go on the opposite principle. They do not waste time upon trying to make every man a good shot, what they aim at is to make all men fair shots at short and moderate ranges, and above all to make the collective shooting excellent—the volley-firing and that sort of thing. It seems to me that long-range individual firing cannot have great effect when we think of the many impediments to good shooting. First of all, there are the defects of vision. Dr. Forbes gave us a lecture[1] last year on the effect of sight on shooting, and it was perfectly appalling to hear his account: there seems to be hardly such a thing as a thoroughly sound eye. He mentioned no end of different defects, which most of us are unaware of. Shortsighted people, like myself, are perfectly well aware of the fact, but, according to him, the great majority of people, who are not aware that they have anything the matter with their eyes, have defects of vision, which must interfere more or less with accurate shooting. Then come the defects of the arm. The best made firearm we have is not thoroughly accurate at long ranges. Think again of the physical and moral disturbing effects of battle, and how all these things combined must affect accurate shooting. It appears, therefore, to me that the Germans are quite right in what I believe to be their views—that long-range individual firing is, as a general rule, thrown away—that long-range firing should be confined to volleys, and the individual firing should be kept for the shorter ranges, where it is likely to be effective. I have been reading a good deal lately about the Lee rifle, and I came here with the idea that the Lee arrangement was the best of

[1] See Journal, vol. xxvi, No. CXVIII.

all. I thought certainly from all that I had heard of the magazine and repeating arms that it was necessary that the cartridges should be put together *en bloc* into the magazine, for it is evident that neither soldier nor sailor would be able in the heat of action to refill his magazine with separate cartridges. Therefore I came to the conclusion that it was absolutely necessary that the soldier should be furnished with cartridge-cases, each of which should contain enough to fill the magazine, an arrangement provided for by Mr. Lee. I was reading a little book, lately published in Germany, called "The Arm of the Present and the Future," in which, after describing all the different arms, the writer gives the preference to that Lee arrangement; but he says at the same time that there are two great defects in it: first of all, the small number of cartridges which it holds, and secondly, the weight of its magazine. However, my preference for the Lee rifle departed when I saw to-day the arrangement that Colonel Fosbery has shown us in the Schulhof rifle; that seemed to me the best possible, always supposing that the interior machinery works correctly, for it must be an immense gain to have everything within the gun and nothing exterior to it. The weight of the ammunition is no doubt a very important thing, and if we are to use magazine arms effectively, we must expect to expend more ammunition than we have hitherto used. The Germans tell us that improvements in firearms lead to diminished expenditure of ammunition, mentioning as an instance that when they introduced the breech-loading rifle in the campaign of 1866 they used less ammunition in proportion per man than had ever been expended in any previous campaign. That may apply to the whole army, but not to the particular individuals hotly engaged, for I know that in the war of 1870 there were several instances of whole regiments that had fired away all their ammunition, though the total expenditure throughout the army was not large. We must, I think, provide for supplying a very large extra amount of ammunition, and though our soldiers now carry eighty rounds, they will have to carry a great deal more in future. The writer of this book, to which I have referred, tries to provide for the extra weight of ammunition in a rather extraordinary way. He is in favour of returning to the old system of paper cartridges. He says, "The present metal cartridge is very heavy; it adds considerably to the weight of the ammunition and causes damage to the powder." I believe all foreign armies use the solid metal cartridge, which lasts a very long time, and this writer thinks that when the powder is kept in these metal things for any length of time some chemical action sets in and the powder is damaged, and that this is the reason why there are frequently a great number of defective cartridges. Then, again, there is the defect of extra weight, so that altogether he is in favour of reintroducing the paper cartridge.

Mr. NORDENFELT: There are only one or two points I wish to mention. The lecturer mentions that the greatest use, perhaps, of the magazine rifle would be in the case of repelling the attack of a storming party or at sea. No doubt, at sea the repeating rifle would be very useful indeed; but at sea it is exceedingly difficult to judge distance. When ashore, the storming party attacks you and comes well within 400 or 500 yards; it makes a rush; the soldier has his sight up after the previous firing from 500 yards, and I suppose, in a great proportion of cases, he will not recollect to put down his sight. I therefore think it absolutely necessary for a magazine rifle to be able to fire at 400, 500, or even 600 yards, without raising the sight. It can be done, and it has been done. The Small Arms Factory at Enfield have lately made exceedingly good rifles for such purposes, and other people as well; but unless something of that kind is done, I do not see the use of firing very rapidly for a couple of minutes if your shot are going far over the heads of the enemy. At sea this is still more important, because there the distances are constantly varying, and, unless you have an extremely flat trajectory, I am afraid the magazine rifle shots would be thrown away. Then, as to practice in field firing: to fire against moving objects has never seemed to me of so much use as firing against small targets. I gave a prize last year to a London corps, to which I have the honour to belong, for firing under the following circumstances:—The shoulders and head of a man to be taken for the target, and each company to send out one squad of their best shots; to double over 300 to 400 yards; to stop three times, and have two minutes given to fire at this head and shoulders, and then the hits to be counted. It was certainly wonderful, with some of the best shots in the country, to see how

few could make good scores within 400 yards under these circumstances—and why? Because the men were pumped, and because they, not knowing the distances, missed. They missed more especially in elevation than in lateral direction. If you have a repeater or a magazine rifle which does not require the sight to be raised within 500 yards a much better target would have been made: and there is very little difficulty in doing that, because if you make it fire "point blank" at 300 yards, the trajectory being low, you could aim beyond that at the man's head, and probably you would hit him in the body.

Admiral SELWYN: I wish to say how very much pleased I am to find the progress made since we listened to Colonel Fosbery last year. First of all, we must congratulate ourselves on the fact that an attempt is being made to settle, once for all, the calibre and proportions of lead and powder, and the material and shape of the cartridge; and on that subject I think I may say that those who began this question of breech-loading tried every kind of thing before they took to the metal cartridge. Paper in all forms was tried, either simply combustible or impregnated in such a way as to form a part of the explosive force. Then skin cartridges, collodion cartridges, in fact, every possible device was resorted to, but there was found a fatal defect in all breech-loaders—the gas spit—and we never did get rid of that until we took to a solid-drawn metal cartridge. Now to go back on anybody's leading or showing on account of presumed weight of cartridge would be to make a step to the rear. The true metallic cartridge properly made does not weigh more than a paper cartridge, which would be efficient. The paper cartridge must have a metallic base, unless it is not to be withdrawn at all, but is to contribute to the combustion in some way; but even allowing that to be the case, there would still be found a fouling which is now taken up by the cartridge-case, and which would then remain in the chamber, and would be a serious and almost a fatal objection. With regard to the calibre and form of the cartridge-case, I hope the decision has not been, or will not be, taken with regard to the infantry weapon alone, but also with a due consideration of what is necessary for the machine-gun. I presume the infantry question must govern the whole—that the machine-gun is only regarded as an auxiliary to the infantry, and that it must to a certain extent subordinate itself to the question of weight to be carried by the infantry, since it is quite clear that while we can easily devote more horse-power to carry a greater number of cartridges for the machine-gun, we cannot increase very materially the weights carried by the soldier. And in this connection I am very pleased to observe a theory which has long been talked of in this Institution—the useless weight of the stock turned into useful weight of cartridges. If I were grouping guns together, breech-loaders, magazine, or repeaters, I should put in the first class those which economized useless weight. I should say we must not add one ounce of useless weight to the gun; all added weight must be strictly confined to the cartridge; every ounce of weight in the gun that is not absolutely necessary must be suppressed; and Colonel Fosbery has touched the point very ably in pointing out that the stock of the gun is one of the most senseless things ever made—4 lbs. of solid wood, equal to 40 cartridges. I am quite sure in America they would long ago have given it up, had not somebody suggested that the great use of the rifle was to knock down your enemy, and consequently you require a club as well as a rifle. I think my prejudice in favour of the Winchester does give way to a certain extent to the Schulhof. I believe that the Schulhof is a very good gun indeed. The one thing I should wish to see changed in it is that bolt operation which sticks out into the palm of the hand. We heard a great deal during the Franco-Prussian War about the effect of that bolt in utterly destroying the steadiness of the man's hand, and sending a tremor up into his arm which rapidly disqualified him for firing with accuracy. It is a fact that the muscles of the hand are specially liable to that kind of tremor which ends in lock-jaw. They are not intended to be so struck; and any man who has used a chisel and mallet knows the difference between using the hand on the chisel and resorting to his mallet. I should like, therefore, to see in that gun a certain form of lever operating the bolt; it is much less objectionable, much less liable to catch, and it would be a very great improvement if that were added to the Schulhof. With regard to the question of shifting or varying weights, I must say that when we come to consider what

is the use of a magazine or repeating gun, when we expect to use the magazine, and how we expect to use it, it does seem to me that the question of weights and the distribution of weights has been very much overrated. I do not expect we shall ever fire with the magazine unless we have an opportunity of kneeling or lying down, or of getting into a very steady position; for it would be madness to throw away the magazine fire in any other way, unless it were a very close volley at a large body of men. Under these circumstances, we shall always have some sort of rest for our rifles; and though I recognize the fact that, having put the cartridges into the butt, it must have sometimes a varying weight, and yet that will not materially influence the aim at any time when the troops are likely to be using the magazine; and, certainly, as the weight of the cartridges inserted does not very much exceed the weight of the wood which is cut away, it simply comes on all ordinary occasions to the same thing. Therefore we have got back our rifle with a lot of useless weight disposed of, and a good deal of useful weight put in. I would suggest whether there is any great use in having a piece of wood to reinforce the piece of steel in front under the barrel, or whether we may not surrender our piece of wood and have something lighter and very much stronger. If it is for the purpose of keeping the hand of the soldier off the hot or cold metal, then I should say we might manage that with a little vulcanite very much more satisfactorily. I hope to see the day when the leaders in these matters will say, "Well now, we have surrendered all our prejudices. Give us the best thing you can, and we will consider it in all its lights, and give due weight to everything that improves our existing infantry arm, while not attaching undue importance to long-range and not forgetting that bullets to be effective must stop a cavalry charge as well as send men to the hospital to die some days after being perforated by an express bullet of small calibre."

Captain McEvoy: In looking into the subject some years ago, I came to the conclusion that there was no safe way of employing electricity in connection with small-arms. I noticed that the cartridge fired to-day by our lecturer was fired by a low-tension current, and this involves the use of a piece of platinum wire. That is too expensive an arrangement, and unless the cartridges can be fired by a high-tension current, by a spark, I cannot for one moment imagine that the invention will present any feature of economy such as to make it generally applicable. Then if a high-tension current is employed there is very great danger of failure, or premature firing, as that character of electricity has a tendency to firing in the direction of any metallic attraction. I would therefore discard it as not being practicable. I was very much interested to see the success of that experiment, but I have no hesitation in saying if electricity is to be employed in small-arms, all that paraphernalia of insulation must be discarded, something simpler must be employed, and the great feature of safety must be looked to; when that is done we may have an electrical firing gun that will be available. At present it is in the stage of a toy, it is very taking, but it wants a good deal more to be done to it. With regard to Colonel Fosbery's remarks as to the value of magazine-guns, I fully agree with him as to the great future they have before them, and I cannot see how fast-firing guns can be ignored, as they must be an important feature in all Services in the future. I firmly believe that magazine, or repeating guns, when brought into action in an emergency, will be looked upon in the light of a timely reinforcement.

Captain Lumley (late German Cavalry): As I have given a great deal of my attention to repeating rifles, and have seen a good deal of what has been going on here and abroad, and have also conversed with many German and French Officers of great experience upon the subject, I may say that they have all but one opinion with reference to the necessity of adopting a repeating arm, but that this entirely depends on anybody else adopting one, for so long as no nation adopts one, there would be no necessity to do so, while on the other hand, as soon as one nation adopts it, every other nation must follow its example. With regard to the expenditure of ammunition, men who are a great deal more competent to give an opinion than myself say it is a fallacy to believe that repeating rifles require more ammunition, because there are only certain moments when the repeating rifle would be used; and I must say I do not agree with Mr. Nordenfelt and others who say that it should be

used at long distances. A repeating rifle should solely be used at close quarters to repel an assault or to prepare an assault, and to repulse an attack of cavalry when the cavalry is bearing down upon you. For we shall see in the next great war that takes place that cavalry will play a great part, and then infantry armed with a repeating rifle will be able to bring it to bear advantageously against a very formidable enemy. The disadvantages of most repeating rifles are that you have always to carry them loaded; therefore what we want is a repeating rifle that can be loaded when it is wanted, a rifle that can be used as a single-loader, and at the word of command can be loaded and used as a repeater. Using it as a single-loader you will only expend the same amount of ammunition as with a non-repeating rifle, and as you should only use your repeating mechanism at the decisive moment, and this moment having passed you will not be in want of ammunition or will have plenty of time to obtain it. Therefore the objection as to waste of ammunition does not lie with the rifle at all, but with the Officers who control the men, in their being able to make the men do as they are taught. Taking all in all the necessity of adopting a repeating rifle comes to this, that if other nations adopt it we must adopt it also. It has been said that if the cartridges are placed in the butt we weaken the stock and could not use it as a club, if this is an objection, what then becomes of our wonderful bayonet? for we do not want the bayonet if we are to use the butt of a rifle as a club; so if we prefer to use a club, we are carrying about a useless amount of weight in the shape of the bayonet.

Admiral Boys: I only rise because Colonel Fosbery has referred to a remark I made last year in this theatre, that for any magazine arm or quick-loader it is desirable the cartridges should be issued in the contrivance to be employed. I am glad to see that he entirely concurs, as I am sure it is the right view. I concur in the distinction he makes between the magazine-gun and the repeater, and for the general requirements of the Service I prefer the magazine rifle. It will make not the slightest difference to the Services how the ammunition is packed as long as it is properly protected and preserved from damp, and can be readily got at. For the Navy the cases when a magazine rifle will be most required will be at the last supreme moment, when ships pass close to each other rapidly. When Captain McEvoy and gentlemen of his calibre send torpedoes in fast boats alongside of our ships, then is the moment that we want an extremely rapid fire. Mr. Nordenfelt objects to magazine arms on account of the complication of altering the sights for varying distances; my view is that when you have to raise your sight at all you do not want a magazine rifle, you only require it when there is no occasion to raise the sight, when you simply have to point a fire rapidly. In boat actions, I think, when two boats are grappling together, then is just the time when five or six very rapidly fired projectiles would have an immense effect, when you could not possibly miss. I would not propose to use a magazine rifle except at close quarters, more especially from boats. With regard to the question of the cartridges I am sure that whatever is decided upon for the small-arm of the Services, if we give Mr. Nordenfelt and Mr. Hotchkiss (who I see is present) a pattern of the cartridge, and adhere strictly to it, they will have no difficulty in adapting their machine-guns to use it.

Colonel Arbuthnot, R.A.: I am not going to say which arm I consider the best, for two reasons. In the first place as I see so many inventors present at this lecture, I do not wish to run the risk of treading on any one's toes; and in the second place, as I am on the Committee for deciding this question, it is not for me to say what the Committee think with regard to the business which has been laid before them. But this much I can say, that not a single magazine arm has come before the Committee up to this present time that does not possess so many disadvantages that there is not one which we should recommend for adoption in the Service in its present condition. I do not at all despair of arriving at a satisfactory arm which shall be suitable for the Navy as well as for the Army, but I think very likely it will end by part of one being taken and part of another, as Colonel Fosbery said in his lecture. I may say it is not the easy matter which many people think it is, and the best proof of that is, that there is not a single nation as yet that has got a magazine arm with which they are satisfied, and when we see that neither the Americans nor the Germans are satisfied with an arm I think we may rest assured that there are

difficulties in the way which are not easily overcome. With regard to the barrel and ammunition, I may say that at Enfield experiments have been carried on for the last two years in trying to get a good barrel and cartridge, and I think we have arrived at a barrel that will meet all requirements, and therefore the time has not been thrown away, because whatever magazine or breech action is eventually adopted, any barrel can be fitted to it. The barrel and breech action magazines are two distinct questions, and as soon as the magazine is settled upon, the barrel will be fitted to it. That barrel has a smaller bore than the present Service barrel; the ammunition is lighter, has a higher velocity at all ranges than any known existing military arm and a lower trajectory. The cartridge is so constructed as to be fitted to the present rifle-bore machine-guns, but it is the same length as the present Gatling, and therefore, when it is adopted, the only alteration which will be required in the existing machine-guns will be to change the barrels. You will then have a machine-gun firing a cartridge superior to any military cartridge at present in the world, as far as its properties are concerned. It is a solid metal cartridge, which I think will meet Admiral Selwyn's views of what a cartridge ought to be, and has given very good results in other ways.

Major-General GORDON: Colonel Arbuthnot's explanations and remarks have anticipated what I had principally to say on the subject of repeating rifles. I may add that the object of the much-abused wooden stock seems to have been lost sight of. I do not think any other material has as yet been proposed that will give the necessary strength and elasticity; any rigid substance touching the barrel would interfere with accuracy. With regard to field firing, I have seen much of it in India, and from what has been said this afternoon, I do not think the main object of its introduction is generally realized. Practice by squads of ten or twelve on a range or on known ground in no way meets the desired purpose. Its intention is to habituate the men to firing in the greatest available masses, as on service, and to enable the Officers and men to see the effect of such fire upon figures and screens which are entrenched, and only placed in such ground as an enemy would occupy. Many advantages have followed this method of carrying out field firing, amongst them, the searching consequence of long-range fire on screens, placed, often out of sight of the firers, in covered positions such as would be occupied by the supports and reserves of an enemy. It was found that this disturbing effect was the result of firing at the longer ranges. The trajectory of the bullets which miss and pass over an advanced trench on the crest of a hill or undulation follows their reverse slopes, and thus makes it necessary that the distances at which such firing should be prosecuted must depend on the nature of the slopes of the ground behind which the reserves may be posted. I entirely agree with the Officer who argued that long-range firing should be carried out by masses firing section volleys. It should be the object of the Officers to carefully choose suitable positions from which this could be efficiently done. The individual firing of a few picked men, at such long ranges, is not the question, because such a feeble fire could never have the spread which alone would disturb an enemy; for this, the present rifle is perfectly efficient. The rapid fire of magazine-guns can only be required at the shorter distances, and if so used at the proper time, their effect must be very great.

Colonel FOSBERY: I have but few words to say in reply. I really cannot follow Major Fergusson back to the beginning of his argument where he disputes the broad principles on which rests the question of the introduction or rejection of magazine arms. It appears to me that we have long passed all that. Again, as for the men losing interest in field shooting—aiming at nothing, and so throwing away all the benefit they may have derived from their target practices and previous training—all that I can say is that the fault must lie with their Officers when they do so. It is clearly the duty of the Officer to see that his men profit rather than lose by such exercises; and to keep up their interest in practices designed to represent, as far as may be, the actual circumstances of war. I think I ought to have explained to Sir Lumley Graham more clearly than I did that moving targets, designed to be used with the tube, have been devised. The tubes are not intended to be used in field firing, but for practice at miniature targets which will instruct the men in the principles on which aim should be taken at moving objects in the field. As for firing at an advancing and retiring enemy, I do not very well see how

one could make targets which would really represent such motions with any degree of truth, or that any motion we could devise would have a corresponding effect.[1] The only thing I can remember to have been done in that way is in an experimental trial which took place at Enfield, when the men were moved gradually up to the target firing for twenty seconds at each halt. I know of no other plan unless, indeed, we could mount our running target on a railway train. I probably have misapprehended the real German view of mass fire. But at all events, I think it may fairly be said that they have given up in despair the idea of obtaining what I still hope to obtain, individual excellence in the fire of masses—not that they have lost sight of the value of the thing could it be got. The reason is probably this, that the German Musketry Instructor is always the Captain of his company. That is, the man gets all the technical instruction he ever gets out of his Captain, as we are proposing to do ourselves. Now, it requires something more than the average Captain of a company to give that class of instruction, to get the ordinary mind of the common soldier to apprehend certain necessary scientific truths, to get delicacy of perception and delicacy of touch out of heavy intellects and hard fingers. This was the duty of the old instructors of musketry, and a very difficult and troublesome duty it was; and I believe that the only thing that kept them up to it and enabled them to perform it as they did, was a certain sort of enthusiasm which earned for many of them the reputation of being mad on musketry subjects, at all events, a set of qualities not to be found in the ordinary Officers of companies, whose instruction can never possess the same qualities to the same extent. With regard to the Boers' shooting being so much inferior to what has been represented, I was talking only three or four days since to a distinguished Officer who commanded a large body of irregulars during the campaign, and had the best possible opportunities of judging; he told me that the Boers' shooting was simply marvellous, and that not only were individuals amongst them extraordinary shots, but that they were so as a people. He had himself seen them knock over antelope running at 500 and 600 yards, and these not picked men, but the average run of the people who did our troops so much mischief. I am glad to find so general an adhesion to my proposition for loading in the cartridges *en bloc*. It is only in this way, I feel convinced, that we shall get the best results from any repeater. As to the question of the weight of ammunition to be carried by the men, an American Officer lately told me that during the War of Secession he commanded a brigade in which one regiment was armed with repeaters, while the others carried the ordinary single-loader, and that the expenditure of ammunition with the repeater was not so great as that with the single-loader, or, at all events, that the single-loaders were out of ammunition five times to once with the repeaters; and I think the explanation is a very simple one. In the first place, the men got so much confidence in their repeaters that they would cheerfully carry as much ammunition as they could get; but, in the second place, they used that ammunition far more scientifically, and with far more deliberation, than did the others. It is not difficult to see what would happen with a repeater. Supposing you have an ordinary single-loader in your hands, and you see a man coming at you, say, at 100 yards, you naturally make some such calculation as this, "I will have a shot at him now, and a second shot when he gets a bit nearer, but I must give myself time to get a third into my gun against he comes to close quarters." So you fire at once at him at the 100 yards, and firing in a hurry probably miss him. You may or may not miss him the second shot, and you may or may not have time to get in your third shot, and kill him at close quarters before he can kill you; but even should you do so you will have wasted two rounds of ball cartridge. But with

[1] Since I made the above remarks a moving target has been designed for the aiming tube which will answer every purpose—the object aimed at being made to approach or recede from the target on which the hits are recorded in a vertical line, and at a speed capable of regulation—thus to keep on the target the sights will have to be continually raised or lowered during the practice, as would be the case when firing at a retiring or advancing enemy—the apparatus being regulated to any speed considered desirable for the purposes of instruction.—G. V. F.

the magazine-gun you reflect that there need be no such hurry about the matter. No time practically is required for loading, and you can wait till he gets within the length of the room and have your three shots at him all the same; waiting quietly you probably knock him over with the first, and the two rounds are saved. Some such process as this is quite conceivable, and would fully account for the economy of ammunition. I think, considering the way in which I introduced the electrical gun to your notice, I need hardly discuss what Captain McEvoy has said on that subject. But I cannot conclude without thanking those who have taken part in this discussion for the kind way in which they have noticed the salient points of a very imperfect paper.

Sir Beauchamp Walker: I think at this very late hour of the evening I shall best meet the wishes of all present by omitting any remarks of my own, and by begging you to empower me to return a vote of thanks to Colonel Fosbery for his valuable lecture, and to add the thanks of those who have not spoken to those who have for assisting in carrying out the discussion on this very interesting subject.

NAMES OF MEMBERS who joined the Institution between the 1st October and 31st December, 1883.

LIFE MEMBERS.

Gordon, L. A. C., Lieut. R.A.
Bates, H. S., Major 3rd Battn. Yorkshire Regiment.
Kelly, A. J., Lieut. R.E.
Goff, G. L. J., Lieut. Argyll and Sutherland Highlanders.
Fleming, E. W., Lieut. R.H.A.
Churchill, M., Major Northampton Regt.
Eustace, J. B., Lieut. R.N.
Williams, W. B., Capt. Wilts Regt.
Askwith, C. W., Lieut. R.N.
Clarke, J. S., Lieut. R.N.
Primrose, Hon. Everard H., Col. Gren. Guards.
Parkin, T., Esq., M.A., F.R.G.S., late Lieut. Royal Cumberland Militia.
Allen, J. R. H., Lieut. R.A.

ANNUAL SUBSCRIBERS.

Richardson, E. H., Lieut. Derbyshire Regiment.
Badham, R. L. S., Capt. London Irish Rifles.
Knox, W. G., Major R.H.A.
Disney, T. R., Lieut.-Col. R.A.
Corbyn, H., Lieut. R.A.
Glyn, J. P. C., Col. Rifle Brigade.
Norman, F. B., C.B., Col. Bengal Staff Corps.
Purvis, J. S., Lieut. R.E.
Hozier, H. M., Capt. late 2nd Life Gds.
Skinner, M. W., Capt. R.E.
Kentish, J., Major 14th Hussars.
Gawne, J. M., Lieut. Royal Lancashire Regiment.
O'Meara, W. A. G., Lieut. R.E.
Blackett, R. S., Esq., late 6th Drag. Gds.
Richards, P. T., Com. R.N.
Gray, P. E., Lieut. R.A.
Barthorp, A. H., Lieut. Northampton Regiment.
Pamphlett, W. F., Assistant Engineer R.N.
Blewitt, A., Lieut. King's R.R.C.
Polhill-Turner, C. H., Lieut. 2nd Drag. Gds.
Roper, A. W., Lieut. R.E.
Crutchley, W. C., Lieut. R.N.R.
Noyes, A. W., Major W. Yorks. Regt.
St. George, A. W., Capt. W. Yorks. Regt.
Vialls, H. G., Lieut. W. Yorks. Regt.
Roberts, A. N., Lieut. W. Yorks. Regt.
Mathew, B., Col. R.E.
Prothero, A. W. E., Lieut. R.N.
Fullerton, A. G., Com. R.N.
Hughes, R. J., C.B., Major-General.
Murray, A. P., Lieut. Gord. Highlndrs.

OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

THE UTILIZATION OF RIFLE FIRE IN THE FIELD.

By Major C. K. Brooke, 1st Batt. East Yorkshire Regt.

Unfortunately the study of the science of "Fire Tactics" has been so neglected in this country, and so little data has been collected, that it is necessary to appeal chiefly to the results of experiments carried out abroad for the facts on which to base a theory of how best to utilize the power of the rifle in the field.

This paper will therefore be based upon, and make free use of, the tables, deductions, and criticisms contained in a "Commentary on the German Musketry Instructions" which appeared in 1882 in the "Revue Militaire de l'Etranger."

The result of the experimental firing conducted near Dungeness in 1879-80 will also be made use of as far as practicable.

Firing in the field may be divided into two categories: Individual, and Collective; the former being the fire of individual men when left to their own initiative, the latter the fire of several men acting together under the orders of a superior.

The discussion of the subject divides itself naturally into two parts; and it is proposed in the first to deal with individual fire, and in the second with collective fire.

PART I.

Individual Fire.

The questions which mainly concern the individual firing of men are:—

"a." The relation which exists at each distance between the size of the object aimed at, and the dimensions of the grouping of a series of shots at the same distance.

"b." The point to aim at.

"c." The employment of fixed sights.

"d." The limit of effective individual fire.

"a." *The Relation between the Objective and Shot Groups.*

The influences which act on rifle firing are so diverse that even when the same man with the same rifle fires a series of about 50 shots without committing the least error, and aiming steadily at the same spot, the bullets

striking a vertical target cover a surface more or less large; this surface represents the vertical grouping of the shots of the series at this distance, and may be called a vertical shot group.

The combined trajectories of all these shots constitute their "gerbe," and this may be likened to a curved horizontal cone, having its apex at the muzzle of the rifle, and its base at the object aimed at.

Plate XXV, Fig. 1, extracted from the "German Musketry Regulations," represents this gerbe or sheaf of shots; and a_5 O$_4$ b_4 its terminal vertical shot group.

The horizontal grouping of the shots of a series is obtained from the vertical shot group by calculating the distance each shot would travel before reaching the ground. Since the drop of a bullet which strikes the top of a six foot high target is known for every distance, the calculation of the drop of all other shots can be practically determined by simple proportion. For example, the drop of a bullet at 500 yards when fired from the Henry-Martini rifle is, from the Dungeness experiments, 64 feet in 6 feet; consequently, if a shot struck the target 4 feet from the ground, its horizontal projection behind the target would be $\frac{6}{4} = \frac{64}{x}$, or the bullet would reach the ground 42½ feet in rear of the target. Plate XXV, Fig. 2 (Ger. Mus. Regn.) graphically represents the horizontal grouping of a series of shots. It has been found by experiment that in these groups, the shots tend to form a sort of nucleus in the centre, and to be more scattered at the margin.

The vertical grouping of the shots from the Mauser rifle takes the form of a circle as far as 150 m. inclusive, and thence the shot groups assume an oval shape of which the longer axis is vertical. The axes of these ovals go on increasing as the distance becomes greater, and their dimensions also vary more or less in accordance with the accuracy of the shooting of each rifle.

The dimensions of the vertical shot groups of the Mauser rifle are shown in Table 1; in which will be seen the percentage of abnormal hits which are subtracted at each distance in Germany. The centre of the shot group is determined by the position of a point which has an equal number of shots above and below it; and an equal number to the right and left of it. Plate XXV, Fig. 3 (G. M. I.) illustrates this. In France, it is not thought that this central point is determined by such a rudimentary method.

Before proceeding further it will be necessary to assume some dimensions for the objects which are most frequently fired at in the field: the following will be the data made use of in this paper; and are, except the height of a standing man, the dimensions adopted in Germany:—

	m.	ft.	in.
Man standing	1·60	or 5	4
„ kneeling	1·10	„ 3	8
„ lying down, but not under cover	0·45	„ 1	6
„ lying down, and under cover	0·35	„ 1	2
Breadth of a man (the vulnerable part)	0·40	„ 1	4
„ „ group of two men	0·80	„ 2	8
„ „ „ three men	1·20	„ 4	0
A cavalry soldier, riding at a rapid rate	2·00	„ 6	8

The relation between the above dimensions and the areas shown in Table 1 must always be borne in mind; for allowing that the sighting of a series of shots is correct, and that no mistake is made in aiming, still these shots will only strike the mark so long as their grouping and the objective have the same extent of surface. When a distance is reached at which a shot group has a larger surface than that of the objective, then many of the bullets, though well directed, will miss their mark; the number of misses increasing in proportion as the area of the shot group exceeds that of the objective.

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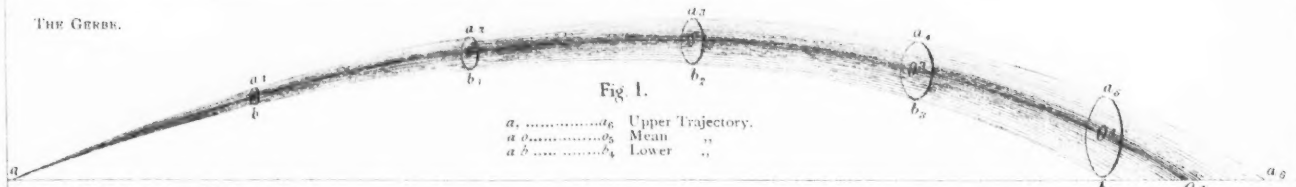
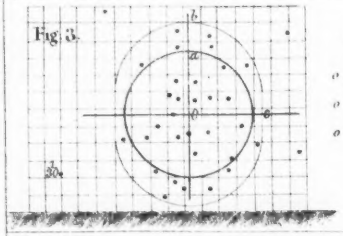


Fig. 1.

a_1 ..... a_6 Upper Trajectory.
a_5 ..... a_5 Mean ,,
a_4 ..... b_4 Lower ,,

Fig. 3.



The vertical grouping of a series of shots.

$o\,a$ Radius of the circle enclosing the larger half of the hits..... .....
$o\,b$ Radius of the circle enclosing all vertical deviations .....
$o\,c$ Radius of the circle enclosing all horizontal deviations.....

} Some abnormal hits not included.

The horizontal grouping of a series of shots.

Fig. 2.

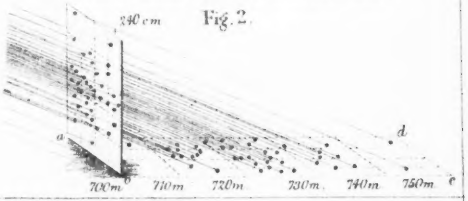
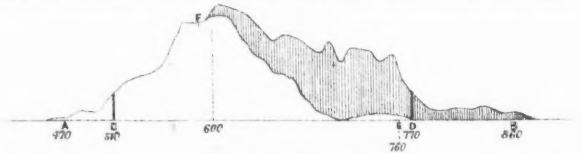


Fig. 4.

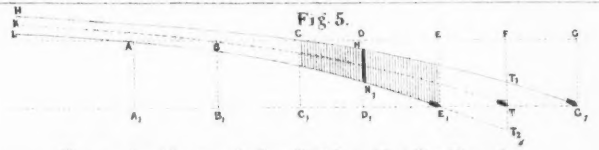
A graphic representation of the combination of the gerbes of the 600 and 700 Metre Sights.



A F E The unshaded portion represents the hits on the imaginary screens 10m. apart) of the series with the 600m. sight.
E F B The shaded portion represents the hits with the 700m. sight.
A B Dangerous ground. C D Effective dangerous ground.
Targets between A and C, and between D and B, have less than 10 hits on them.

The Vertical Scale ($\frac{1}{12\frac{1}{2}0}$) is five times that of the Horizontal.

Fig. 5.



Space enclosed between the lines H C G_1 and L A E_1 = The gerbe.

C C_1 = 1m 80 or 6 ft.
H C G_1 = Upper trajectory of gerbe.
L A E_1 = Lower ,, ,, ,,
K B T_1 = Mean ,, ,, ,,
A_1 G_1 = Dangerous ground.
B F = ,, zone, or the Margin.
C E = Zone swept by the entire gerbe.
E_1 G_1 = The ground struck.
N N_1 = The nucleus; D B = D F = $\frac{B\,F}{4}$ = ¼ Dangerous zone.
T_1 T_2 = Height of the shot group at the extremity of the range of the sight in use, aim being taken at the foot of the mark.

* The Diagram is a rough approximation of the 500m. gerbe with regard to its vertical representation. The horizontal measurements are considerably reduced.

Plate XXV

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For example, with correct sighting and accurate firing, it is necessary that the objective at 300 m. should be 48 cms. wide, and 58 cms. high, in order that 95 per cent. of the shots should strike it; if the object fired at had a less width or height, then a proportionably smaller number of hits would be made.

Passing on, the several trajectories which together define the shape of the "gerbe" must be glanced at. The mean trajectory of a rifle for any distance can be graphically traced by connecting the centres of a series of intermediate vertical shot groups, and is represented in Plate XXV, Fig. 1, by the line a, O.... o_5. The upper trajectory is traced by joining together the upper parts of these same shot groups; and the lower trajectory by joining all the lower parts of the groups: the line a, a_1, ...a_6 shows the former, and the line a, b, ...b_4 the latter.

The ordinates of the mean trajectory are the distances of the centre of the shot groups above the line of sight; the ordinates of the upper and the lower trajectories are obtained by adding to, or subtracting from the ordinates of the mean trajectory, half the vertical axes of the shot groups at the several distances.

For example, to find the ordinate of the upper trajectory of the 400 m. gerbe, at say 300 m.; add 29 cms., half the vertical axis of the shot group at 300 m., to 1·44 m., the ordinate of the 400 m. trajectory at the same distance, and their sum 1·73 m. is the ordinate required. Table 2 (G1, Ger. Mus. Inst.) shows the ordinates of the trajectories with the fixed sight of 270 m., the flap sight of 350 m., and the sight of 400 m.

If a gerbe be pictured mentally as a solid curved cone, lengthened by the elevation given to it, and having its terminal vertical area rapidly increased as it is directed on more and more distant objects; then the meaning of the term "shot groups" at various distances will become apparent, and they will be seen to be merely a series of vertical sections taken through the imaginary solid cone at the different distances. Looking thus at a gerbe, the conclusion arrived at from the foregoing investigation may be defined under the statement, that, in individual firing, the relation between an objective and a shot group is the relation that exists between their respective areas at the distance fired at.

"b." *The Point to aim at.*

The shot groups in individual firing have hitherto only been considered with reference to the object aimed at, when this has been at the same distance as that of the sight made use of: they must now, however, be considered with reference to an object which is at a less distance than that of the sight employed: there are two cases to examine.

(1.) When the aim is directed at the object.

(2.) When the aim is directed at an object whose distance from the firer corresponds with the sight made use of.

(1.) For example, in the first case let the aim be directed with the 350 m. sight at the foot of an object 300 m. from the firer; then if reference be made to Table 2 it will be seen that the centre of the shot group at this distance is 70 cms. (the ordinate of the 350 m. trajectory at 300 m.) above the line of sight, and as this is directed at the foot of the target, the centre of the shot group may be taken as 70 cms. above the ground.

But if under the same conditions the aim had been directed at the centre of the target (90 cms. above the ground) then the centre of the shot group would be 90 + 70 cms. or 1 m. 60 cms. above the ground: and as the semi-diameter of the vertical axis of the shot group at 300 m., Table 1, is 29 cms., then the upper trajectory of the gerbe would pass 1 m. 60 cms. + 29 cms., or 9 cms. *above* the top of the target, and in consequence many shots would fail to hit:

whereas, if the aim had been directed at the foot of the target the whole of the shot group would have struck it.

The movement of the shot group is well shown in Table 3, in which the upper and lower trajectories of 350 m. gerbe are recorded as the aim is directed either at the foot or the centre of the targets placed at intervals of 50 m. from the firer. The trajectories are obtained as said before by adding to or subtracting from the ordinates of the mean trajectory the semi-diameters of the vertical axes contained in Table 1.

(2.) In the second case the position of the firer has to be taken into account, as the aim is directed at a mark beyond the object fired at. The heights of the different firing positions are in Germany laid down as under :—

Standing	1 m. 50 cms.
Kneeling	·90 „
Lying down	·30 „

It is evident, since the trajectory follows the line of sight, that if the latter be raised the ordinates of the former will be increased at all distances between the firing point and the object aimed at. Take for example the line of sight proceeding from a man standing to the centre of a target 1·80 m. high, and the line of sight directed by a man kneeling to the same place on the target : the former is a line falling from 1·50 m. to 90 cms., the latter is a horizontal line 90 cms. above the ground ; the firing position of a man kneeling and the centre of the target coinciding in height. Table 4 shows the height of the ordinates of these several lines of sight at different distances, under the conditions that the aim is either directed at the foot of the target, or at its centre.

To obtain the ordinates of the mean trajectory of 350 m. gerbe, it is only necessary to add to the ordinates of the line of sight in Table 4, the ordinates of the 350 m. trajectory as given in Table 2 ; the result is shown in Table 5. In order to further define the movements of the shot groups at intermediate distances, Tables 6 and 7 have been added ; they have been obtained respectively by adding to or subtracting from Table 4, the semi-diameters of the vertical axes contained in Table 1.

Using the above data, the position of the shot group on a target at 300 m. can be examined, when aim is taken with the 350 m. sight at another target at 350 m.

Let aim be first taken at the foot of the 350 m. target by a standing man ; then by Table 6, the upper trajectory of the shot group at 300 m. will be only 1·20 m. from the ground ; whereas, if the firer aimed at the centre of the target it would be 1·97 m. to 17 cms. off the target : again, if the firer kneels, and aims at the bottom of the target, the upper edge of the shot group will be 1·11 m. above the ground; but if he aims at the centre of the target it will then be 1·89 m. from the ground, that is 9 cms. off the target.

Thus when firing either standing or kneeling, and aiming at the centre of the distant target, the upper part of the 350 m. gerbe passes above the 1·80 m. intermediate target, placed at 300 m. And the deduction may be made that when an object is 50 m. short of the mark aimed at, aim should be taken at the foot of this mark, both when firing standing or kneeling.

Before proceeding to consider generally how the 350 m. gerbe acts at all distances intermediate between the firer and 350 m., a glance at a battle-field must be taken. In a battle which is intended to be brought to an issue, one side must act on the offensive, the other on the defensive ; the *rôles* may be interchanged, but at any given moment the opposing front lines of the adversaries must be either advancing to the attack, or staying still to defend the position attacked ; therefore the distance between the two sides tends to diminish, and it becomes most important that the intervening space between the adversaries should be swept by a storm of bullets. The ideal of rifle fire

on the field is reached, when no bullet in the intervening space between the opponents passes over the head of a standing man: that is, does not rise higher than 1·60 m., or 5 feet 4 inches above the ground.

Other kinds of actions there are: demonstrative, and retreating; in the former a delaying fire is made use of, and time is given to work out distances; in the latter, the victors being safe, have to raise their sights as the enemy flies before them. But before the action is decided, when the strain is most intense and time most limited, then fingers must hold firmly the rifle which may at any moment be required for use in the way our forefathers handled it; they cannot be loosened to fiddle with a sight, or to adjust it to distances of 50 yards, nor can the eyes be lowered for the purpose, or taken off the enemy, when he is advancing on us, or we on him.

In discussing this question of rifle fire in the intervening space between closely opposing forces, tables based on the employment of the 350 m. sight will alone be made use of; for if they serve to prove that it is advantageous under the above circumstances to aim at a certain portion of the objective, then analogous tables based on the use of other sights are not needed as they would only tend to confirm the same fact.

If Table 5 be examined it will be seen, that when firing standing and aiming at the bottom of the target, the centre of the shot group will pass over the heads of standing men for 150 m., viz., from 50 m. to 200 m.: if aim is taken at the centre of the target, the centre of the shot group will clear a man for 250 m., viz., from 50 m. to 300 m. Again, Table 7 shows that when the firer is standing, and aim is taken at the bottom of the target, the lowest part of the gerbe passes over a standing man from 50 m. to 200 m., and if aim is taken at the centre of the target from 50 m. to 250 m. Table 6 shows that the upper part of the gerbe under similar conditions passes respectively over a man's head from 50 m. to 250 m., and from 50 m. to 300 m. Further, if a man is firing lying down and aim is taken at the middle of the target, the whole of the shot groups for 100 m., viz., from 150 m. to 250 m., pass over a man's head; whereas if aim is taken at the bottom of the target, the whole of all the shot groups strike a standing man.

From all these facts the deduction may be: that when aim is taken at the bottom of an object the intervening space swept by the gerbe is lengthened.

Another point in the question must be considered, viz., the effect of taking a fine or full sight. At 300 m., if the former is made use of, the mean trajectory is depressed 15 cms., and if the latter, it is raised a similar amount. Looking at Table 5, it will be seen that at 300 m. the use of the full sight will raise the centre of the 350 m. gerbe above the head of a standing man, when aim from the kneeling or lying down position has been directed at the centre of the target; whereas under similar conditions, if aim had been taken at the foot of the target the full sight would not have caused any shots to pass over a man's head. Hence the deduction may be made, that aiming at the foot of an object diminishes the evil resulting from the use of a full sight.

When a fine sight is employed in conjunction with aiming at the bottom of the target more ricochets are caused, and this brings into prominence an objection that might be raised to aim being always directed at the foot of an object, namely, that when the correct sighting is used only one-half of the shot group will directly strike the mark. The action of ricochets can be studied by the light thrown on them by the Dungeness experimental firing; in the report it is stated that "the bulk of ricochet hits is effective," and that the mean rise of a bullet is twice that of its drop. Having this data, the objection raised can be met, and the following example may serve as an illustration. Let aim be taken with the 350 m. sight at the foot of a target at 350 m., then by Table 7 the lower trajectory will theoretically pass 34 cms.

below the target, but the bullets will really strike the ground in front of the target. This distance may be obtained proportionally from Table 1, which shows that a bullet fired under the circumstances above stated falls 39 cms. in the last 25 m., consequently the bullets in question will strike the ground 18 m. from the target; since the rise is twice the drop, the bullets in ricocheting will strike the target 2×34 cms., or 68 cms. from the ground. It may be noticed that the height at which the shots of the lower trajectory ricochet into the target, always coincides with the vertical axis of the shot group at the distance fired at.

As the lower trajectory represents the path of the bottom bullet of a gerbe, it follows that in the case discussed all the bullets strike the target.

From Table 1 it will be seen that up to 600 m. the longer axis of a shot group does not exceed a man's height; consequently the deduction may be made that if aim is taken at the foot of a standing man he is liable to be struck by all the ricochets proceeding from the lower trajectories of the several gerbes up to 600 m.

Tactical reasons have been adduced in support of the principle of aiming at the foot of the object, and they have been stated as follows: "If the smoke hides the objective it is impossible to aim at its centre, while on the contrary it is very easy to distinguish and aim at a mark taken on the line of separation which exists between the cloud of smoke and the ground, this line being clearly defined in the field. On the other hand, if the adversary, while advancing, disappears behind some artificial shelter, or is lost to sight in a depression in the ground, aim can still be taken at the entrenchment, or at the mark on the ground previously selected, the bullets thus fired will have a good chance of being well directed. Besides, is not the soldier in the heat of action always tempted to take too full a sight? in making him aim at the bottom of the object a compensating influence is brought to bear on this fault, which is so common amongst men in the field." Further by thus aiming at the bottom of the objective the gerbe is lowered, and the enemy as he advances, plunges himself more deeply into the rain of bullets, instead of getting out of it, as he would, if aim had been taken in the centre of the object fired at.

To sum up, aim in individual firing should always be directed at the foot of the object for the following reasons:—

"a." That the intervening space swept by the gerbe is lengthened.

"b." That the evil arising from the use of a full sight is mitigated.

"c." That the ricochets of the lower half of all gerbes up to 600 m. are better utilized.

"d." That tactically it is advantageous.

"c." *The Employment of Fixed Sights.*

It has been shown that for tactical reasons soldiers cannot adjust their sights at the critical moment of the combat, either when they are advancing rapidly on the enemy or he on them. The maximum distance which separates the opposing sides at the commencement of this stage of an action, may be assumed to be about 400 yards (360 m.), therefore a fixed sight or fixed sights are required to sweep this space. The number of sights employed must be limited, one would be best, but two are the most that would fulfil the required conditions. In Germany two are made use of, viz., a 270 m. fixed sight, and a 350 m. easily raised flap sight. An examination of the action of these two sights will be sufficient to prove if the principle of the use of fixed sights is advantageous or not. Unfortunately the question cannot be discussed with reference to our own Martini-Henry rifle, as no accurate data is published, and it is very doubtful if the necessary long-continued experimental firing has ever been carried out.

To aid in the investigation, Tables 8–11 have been calculated in a similar

manner to Tables 4–7; and, in addition, the action of ricochets has been added to Tables 5–7, and embodied in Tables 9–11.

First with regard to the action of the 270 m. sight: if Tables 9–11 be examined it will be seen that the whole of the gerbe proceeding from men firing in the standing position, and aiming at the bottom of a target, will strike a standing man (5′ 4″ or 1·60 m.) throughout its course up to 270 m.; with the solitary exception that the bullets in its upper trajectory pass 2 inches above a man's breast at 190 m. If the action of ricochets is included, the same tables show that the ground swept by the gerbe may be extended to 300 m.; thus, practically, men firing standing and aiming at the foot of their objective, cover with their fire any standing man up to 300 m. Again, if the ordinates of the gerbe of men firing in the kneeling or lying down position be looked at, it will be seen how much closer the gerbe sweeps to the earth; and as few men in action would be firing otherwise when the enemy was within 300 m. of them, the efficiency of the gerbe is largely increased.

Another point must be taken into account, that is, when aim is taken at any object at a less distance than 270 m., the line of sight is proportionably depressed, and the gerbe in consequence passes closer to the ground.

From all the above it may safely be concluded that the use of the fixed 270 m. sight, combined with aiming low, enables all the ground in front of the firer to be swept up to 300 m.

To cover the remaining space, viz., up to 360 m. or 400 yards, the 350 m. sight will suffice; looking at Tables 5 to 7 it will seen that with a standing man aiming at the foot of a target the upper trajectory of the 350 m. gerbe at 300 m. is only 1·20 m. above the ground; and that at 360 m., including the action of ricochets, no shots rise higher than 1·06 m.; again, the mean trajectory at 300 m. will strike a kneeling man, and at 360 m. its ricochets only rise 0·06 cm. above a man lying down; hence with flap sight of 350 m. all the ground between 300 m., the limit of the action of the 270 m. sight, and 400 yards, is thoroughly swept; and the conclusion is arrived at that two sights, combined with aiming at the foot of the mark, are sufficient to keep all the ground up to 400 yards well under fire.

Incidentally it may be observed that the analysis of the action of these two sights affords a strong argument in favour of reducing the trajectory of the rifle, for if this were flattened one fixed sight would cover all the ground up to 400 yards.

"d." *The Limit of Effective Individual Fire.*

Individual fire has previously been defined as "the fire of individual men when left to their own initiative;" that is to say, it is the fire of skirmishers freed from all directions, therefore free to choose their object, their sight, and to regulate their own consumption of ammunition. Accepting this definition, it becomes necessary to fix some limits within which this fire may be employed, otherwise a serious waste of ammunition would take place. These limits may be theoretical or practical; the first case postulates a very good shot making no mistakes, and knowing the exact distance; the second assumes that two factors, at least, will always militate in the field against attaining the theoretical result, viz., errors in aiming, and errors in estimating distance.

First, with regard to the theoretical limit: if infantry fire against infantry the largest objective is a standing man, 1·60 m. or 5 feet 4 inches high; turning to Table 1, it will be seen that the height of the shot group at 600 m. is 1·58 m., and its width 1·26 m.; this may be taken to represent a group of three men standing side by side; hence a perfect shot, knowing the exact distance, may have a chance of putting 91 per cent. of his shots into these

three men. But if this same man, under similar conditions, were to fire at a standing man at 700 m. nearly a fourth of his shots must pass over the man's head; for the height of the shot group at 700 m. is 2·12 m., whereas the height of a standing man is only 1·60 m. Consequently with regard to firing at infantry the theoretical limit of individual fire may be fixed at 600 m.; provided, that the aim is absolutely correctly taken, that the exact distance is known, and that the objective is not less in size than three men standing side by side. The mere statement of this conclusion is enough to show its eminent unpracticability, and that to let the mass of men fire individually at this distance would lead to an enormous loss of ammunition.

What then is the practical limit for the employment of individual fire in the field? As said before, two factors govern it: errors, in aiming, and in judging distance. Errors in aiming cause either an increase or decrease of angular elevation, and a consequent rise or fall of a bullet on a vertical target, and it has been stated that these errors range from 3 to 6 and up to 12 millimetres in the first metre measured from the muzzle of the rifle: this is equal to angular errors of about 10, 20, 30 minutes, and gives rise to a vertical displacement of:—

0·30 m.	....	0·60 m.	....	1·20 m.	at	100 metres.
1·20 „	....	2·40 „	....	4·80 „	„	400 „
1·50 „	....	3·00 „	....	6·00 „	„	500 „
1·80 „	....	3·60 „	....	7·20 „	„	600 „

But though the vertical displacement increases with the distance, the horizontal decreases; for example, at 200 m. an error of 1 minute gives rise to a horizontal displacement of about 8 m., whereas at 500 m. this is reduced 5 m., and at 1,000 m. to 3 m.

Assuming that under the circumstances of firing at an enemy, the majority of men fire high with the minimum error of 10 minutes, their shots at 400 m. will be raised 1·2 m. above the ground; if to this be added half the height of the shot group at this distance, 0·42 m., the centre of the gerbe will be 1·62 m. high; that is, the mean trajectory will just clear the heads of standing men. Again at 500 m. the mean trajectory will be 2·09 m. above the ground, 0·49 m. above the head of a standing man. Hence on account of inaccuracies in aiming, and the tendency men have to fire high in action, the limit of individual fire from this point of view should be fixed at 400 m.

With regard to errors in estimating distance, taking into account the difficulty of judging distance in action, it is fair to assume that errors of a tenth of the distance up to 300 m., a seventh up to 600 m., and a sixth up to 1,200 m., will be committed. In Table 12, the probable errors in judging distance from 400 m. to 600 m. are compared with the extent of ground swept by the entire gerbe at each distance, assuming that the objective is a standing man, 1·60 m. high. From this table it will be seen that at 400 m., errors in judging distance can cause but few shots to miss, as the zone swept by the entire gerbe is 106 m. in extent, while the probable miscalculation of distance is only 57 m. At 450 m. these spaces are practically equal, and most of the shots will hit the objective; but at 500 m. an error of 21 m. will prevent any shots striking the object; hence from this standpoint the limit of individual fire must be fixed at 450 m.

Taking both the above factors into consideration, the limit of effective individual fire at standing men may be placed at 400 m. or 450 yards for the great majority of men, but a good shot, knowing the exact distance, may be permitted to fire up to 600 m. or 650 yards. The limit of individual fire at kneeling men may from similar calculations be placed at 400 m. or 450 yards for good shots, and at 250 m. or 275 yards for ordinary men; lastly, the limit for individual fire at men lying down may be fixed at 200 yards.

PART II.

Collective Fire.

Before proceeding to an examination of the action of collective fire, it is well again to point out, that the limits for individual fire laid down in the first part of this paper apply solely to the Mauser rifle: a rifle with a lower trajectory would have a flattened gerbe, with diminished transverse section, and hence the limit for its employment in individual firing would extend beyond that fixed for the Mauser; still, at the same time, the principles on which these limits are fixed remain the same in both cases. Similarly, in the following discussion, the action of the Mauser rifle will alone be under review, but the principles which underlie its usefulness in collective firing will apply to any other rifle; hence the study becomes useful as a clue to the study of the action of all rifles.

Collective fire, as said before, is "the fire of several men acting together under the orders of a superior," and since at 400 m., the limit of individual fire from the Mauser rifle is reached, the action of collective fire must be studied from 450 m. onwards.

Method of Obtaining a Record of the Result of Collective Fire.

The plan adopted in Germany to obtain a record of the flight of bullets is approximately the same as that in France, Italy, Austria, and England; but, since fuller details of the method of conducting these researches are published in the first-named country, the German plan will be described as a type of how such investigations are generally carried out.

The effects of collective fire have been determined in Germany by means of experiments on a large scale carried out at the Musketry School at Spandau. The experiments extended over a considerable length of time, and were executed by firing a great number of rounds in order to reduce to a minimum all abnormal influences. The men firing were relieved from time to time, and were sent to Spandau from their regiments only a few days before taking part in the experiments; they were second and third class shots, that is, men respectively in their second or first year's service; they were in marching order, and had to make a march of some hours before arriving on the practice ground. The fire was conducted by means of volleys fired by men lying down using rests, and at targets 1·80 m. (6 feet) high and 20 m. (22 yards) wide. The number of men firing varied from 10 to 50, as a rule 25 were employed; the number, experiments have shown, has hardly any influence on the results, provided there are at least 10 men firing. The men were extended over 20 m., a space equal to the extent of the target, and were ordered to aim straight to their front and at the bottom of the first target of the series.

Care was taken to choose a flat surface parallel to the line of sight, on which to place the targets, thus the tops of all the targets of the series were practically level. The targets were made of some slight material covered with paper, and stretched on easily movable frames. They were arranged in column, and were separated by distances deduced from the total theoretical length of the dangerous zone, in such a manner that a bullet which grazed the top of one target struck the bottom of the target next behind it; under these conditions, each bullet theoretically left but one mark on the entire series of targets. The intervals between the targets are shown in Table 13, which is a copy of Appendix L of the German Musketry Instructions of 15th November, 1877. In order that all the shots should be registered, the targets had a depth of 150 to 200 m. when a single sight was used, and a depth of 300 to 400 m. when two sights, with a difference of 100 m. between them were employed. For example, with the line of sight of 600 m., the

targets were placed at 535, 586, 629, 669, and 700 m., thus having a depth of 165 m.

When the firing was concluded the number of hits were counted to verify that each bullet had left but one mark of its passage ; then the position of the hits on each target were taken off, and from this vertical record the horizontal representation of the graze of each bullet was calculated.

General Results of Collective Fire.

Such is the method by which the data for the examination of the action of collective fire was obtained in Germany. The results, broadly speaking, are that the hits spread remarkably evenly over a space lengthened in the direction of the line of fire and depending for breadth on the extension of front given to the fire. A nucleus shown by a slightly denser grouping of the hits, appears towards the centre of the surface struck ; the hits outwards to the periphery becoming more and more scattered. The regularity with which the hits are distributed is due to the reciprocal action of the different influences which tend to make the bullets spread, and it is to this reciprocal action that the great value and great certainty of collective fire is due. The longitudinal dispersion remains nearly constant at all distances, and up to 1,400 m. it has even a tendency to diminish ; this is due as said before to the fact, that the same angular error in elevation has a diminished influence on the range of the bullet in proportion as the distance is increased.

Construction of Tables to show the Result of Collective Fire.

In order to arrive at the value of the experimental firing, the results obtained on a series of targets placed as before described are decomposed, under the supposition that targets 1·80 m. high, and equal in width to the gerbe, are placed at intervals of 10 m. along the entire path of the bullets ; then the number of hits which would have struck each of the targets is calculated, and thus the terms of the series required are obtained. For example, in order to find the number of hits in a target at 400 m., it is only necessary to count the number of grazes that lie between its position and that of a parallel target 75 m. in its rear, since the bullets making the grazes must have passed within 6 feet of the ground at 400 m. ; the dangerous zone or "margin" of the 400 m. trajectory with reference to a 6 feet target having a depth of 7·5 m.

The target which receives the largest number of hits is called the nucleus of the series.

Table 14 "A" (K_1 No. 1, G.M.I.) gives the destructive effect of a collective fire with a single sight against a series of targets 1·80 m. high and 20 m. wide ; that is, against fifty men standing side by side. And also the effect of the same fire on a company column, the men standing ; this is obtained by adding the depth of the column to the extent of the dangerous zone and counting the number of grazes which lie in this space.

Table 14 "B" (K_1 No. 2, G.M.I.) gives the destructive effect of a collective fire with a single sight against a series of targets 45 cms. high and 20 m. wide ; that is, against fifty men lying down side by side, not under cover ; and also the effect of the same fire on a company column lying down, this is obtained in the same way as described above.

Table 15 "A" (No. 3, K_2, G.M.I.) gives the effect of a collective fire with two sights against a target 1·80 m. high and 20 m. wide, *i.e.*, against fifty men standing side by side.

Table 15 "B" (No. 4, K_2, G.M.I.) gives the number of men's breadths (0·40 m.) struck by a collective fire with two sights ; this is obtained by dividing, in the direction of the line of fire, the horizontal representation of the grazes into bands 0·40 m. wide, and then at each distance counting the

number of bands which in a length equal to the dangerous zone at the distance have one or more grazes on them. For example, at 500 m., when the 500 m. and 600 m. sights are combined thirty-four men's breadths are hit; that is, on each of these men's breadths extending 65 m. (equal to dangerous zone at 500 m.) behind the target, there has been counted one or more grazes, with the same fire at 600 m. forty-one men's breadths are hit.

Observations on the Series obtained from the Use of One Sight.

"a." The length of a series from the first term to the last represents the depth of what is called the "dangerous ground." See Plate XXV, Fig. 4.

"b." In the tables, the sum of any series does not represent the number of bullets that have struck the targets, as the same bullet may traverse several successive screens; for example, the bullet which grazes the top of the screen at 400 m. will pass through the next seven screens, since the margin of the 400 m. trajectory is 75 m., and the screens are arranged at intervals of 10 m. apart.

"c." The position of the nucleus of the shots of a series has been found to be about half the length of the "margin" in front of the target up to 700 m.; this is caused by the aim being taken at the foot of the first target of the series. After 700 m. the position of the nucleus corresponds practically with that of the object fired at; this is due to the shading off of all objects at a distance, and the consequent unconscious tendency of the firer to aim more at the centre of his mark.

The "margins," or dangerous zones of the Mauser rifle, depending on a target 1·80 m. high are as follows:—

75	metres	at 400	metres.	17	metres	at 1100	metres.
65	„	500	„	15	„	1200	„
48	„	600	„	13	„	1300	„
38	„	700	„	12	„	1400	„
32	„	800	„	10	„	1500	„
25	„	900	„	9	„	1600	„
20	„	1000	„				

The position of the nuclei in front of the target as taken from the tables are:—

35	metres	for 400	metres sight.
30	„	500	„
21	„	600	„
18	„	700	„

By doubling the above numbers and comparing them with the extent of the dangerous zones at the same distances, it will be seen that the position of the nuclei in front of the object aimed at is practically one half of the extent of the dangerous zone.

Distances.		Position of nuclei.			Extent of dangerous zone.	
400	metres.	35 metres	×2=70	metres.	75	metres.
500	„	30 „	×2=60	„	65	„
600	„	21 „	×2=42	„	48	„
700	„	18 „	×2=36	„	38	„

"d." The terms of the series in the several tables were obtained, as said before, by means of a large number of experiments; consequently the firing of 100 rounds will not give exactly the same results; but the approximation will become closer as the number of rounds fired is increased. At the same time the length of the series will not vary considerably whether the number of rounds fired be either increased or diminished, provided the number is not

reduced below fifty, which is the minimum number required to show clearly the grouping of the hits.

"e." The term "the effective dangerous ground," see Plate XXV, Fig. 4, has been applied to the space contained between the first imaginary screen of a series which has received ten hits, and the last which has received the same number. With the sight of 400 m. when firing at the 1·80×20 m. target, this ground commences 140 m. in front of the nucleus and ends 70 m. behind it, and hence has an extent of 210 m. In the same manner, with the sights of 500 m. and 600 m. its length is 200 m. and 170 m. respectively. With the 800 m. and the 1,000 m. sight the effective dangerous ground is 110 m. in extent. In the effective dangerous grounds from 400 to 900 m. at least one-tenth of the rounds fired are effective.

The following table extracted from the German Musketry Instruction of 28th September, 1875, is interesting from this point of view.

Table 16.

Sight.	Number of rounds fired.	Depth of effective dangerous ground.	Approximate number of hits	
			At the limits of the effective dangerous ground.	At the nucleus.
Metres.				
400 to 600	100	150	15	50 to 70
700 to 800	100	100	10	30
900 to 1200	200	100	10	30 to 50
1300 to 1600	300	100	10	undetermined.

"f." Errors in judging the distance must not exceed half of the extent of the effective dangerous ground, otherwise only a few scattered shots would hit the mark; thus at 500 m. an error of 100 m. would throw almost all the shots off the object; and as here the probable error in judging the distance would be about 70 m. it would not be advisable to use only one sight unless the distance were approximately known; for this reason the German Instructions state that "beyond 400 m. the employment of a single sight does not promise good results unless the mark is stationary, and there is the time and the means to regulate the fire, and finally unless the configuration of the ground in front is not likely to diminish the effectiveness of the fire." "In all other cases, and especially against moving objects which advance or retire, it is necessary to make use of two or more sights having a difference between them of 100 m."

Observations on the Series obtained from the Use of Two Sights.

"a." The series representing the effect of a collective fire with two sights having a difference of 100 m. between them, have not been determined directly by experiment. Thus to find the terms of the combined series with the 600 m. and 700 m. sights, it is necessary to add to the terms of the series with the 600 m. sight, the terms of the series with the 700 m. sight. Table 17 shows how this is effected.

"b." The effective dangerous ground when two sights are employed has a greater depth than when only one sight is used, and this with an equal consumption of ammunition. For example, if reference be made to Table 17 it will be seen that with one sight, and an expenditure of 200 rounds, this ground

extends from 510 m. with twenty-two hits to 690 m. with ten hits ; that is to say, it has a total depth of 180 m. ; but if 200 rounds are fired with the combination of the 600 and 700 m. sights, then the depth of the effective dangerous ground is extended to 260 m.

The mingling of these two series is graphically shown in Plate XXV, Fig. 4.

In firing with two sights up to 700 m., and with three sights up to 1,200 m., the extent of the ground swept by the bullets is such, that the effects of errors in judging distance, of atmospheric influences, and of those due to the bullets falling on sloping ground, are eliminated ; and thus the shots can be grouped around the objective. Table 18 shows the grouping of shots when the 1,100, 1,200, and 1,300 m. sights are employed together, the effective dangerous ground will be seen to extend uninterruptedly from 1,090 m. to 1,220 m., and thence with three gaps to 1,300 m. The total effective depth may be taken as 130 m., but the probable error in judging distance at 1,200 m. amounts to 180 m. Therefore, since the effective dangerous ground at any range should at least be double the amount of the probable error in judging distance at that range, the firing of 300 rounds under the above conditions would be ineffective so long as the distance from the objective was not accurately known. If twice 300 rounds were fired Table 18 shows that the effective dangerous ground would have a depth of 300 m., extending from 1,040 to 1,340 m., hence under these conditions, if a rough approximation of the distance could be obtained the fire would be effective, but if not known, it would be only partially effective. This reasoning applies, of course, to the Mauser rifle, but given a rifle with a flatter trajectory, causing consequently a greater dispersion of bullets at long ranges, then a combination of three sights would be effective at a considerable distance beyond 1,200 m. The above shows that in long-range firing the amount of ammunition required to produce the required effect must be carefully determined for each case as it arises ; hence the decision as to the employment of this kind of fire must be retained in the hands of the senior Officers of the battalions.

Returning to the discussion of the use of two sights, it has been found that, as a rule, when firing 100 rounds, the number of hits on the screens does vary very much from the number made when only one sight is employed. Table 19 gives the percentage of hits when the 600 and 700 m. sights are used together, and when only the 600 m. sight is employed.

Before proceeding further it is advisable to obtain some idea, by means of experimental data, supplemented by theoretical deductions, of the vertical grouping of the hits, and of the shape of the gerbe in collective firing, in the same manner as the different trajectories were analyzed in individual firing. It will be useful to compare the depth of the ground struck as calculated from the above theoretical conditions, with its actual extent as derived from experimental firing, and thus to bring out the several reciprocal influences which determine the dispersion of the bullets.

The Dimensions of the Shot Groups in Collective Firing.

The factors which govern the size of the shot groups in collective firing are, "a." Differences in the rifles. "b." Errors in aiming.

"a." *Differences in the Rifles.*—If a certain man fire 100 rounds, and make use of ten different Mauser rifles, it has been found that the hits on the target have a greater vertical extension than the major axes of the shot groups as shown in Table 1, which are derived from the firing of the same man with the same rifle. This increase in vertical dispersion is due to differences in the construction of the rifles, and to differences in the treatment it has received while in the soldier's possession. In fact, in spite of the progress made in modern industry, it is impossible to obtain products perfectly identical to each other, and even if this were attainable, the

different usages rifles are subjected to would, after a year or two, create differences which would influence the grouping of the shots on a target. Experience has shown that after the Mauser rifles have been in use two years, an angular error in elevation of 0·333 m. in 100 m. has supervened; therefore in collective firing this addition has to be made to the major axes shown in Table 1. For example, at 300 m. the major axis would be $3 \times 0{\cdot}333 + 0{\cdot}58$ m. (the major axis in individual firing at 300 m.) or 1·58 m.

"b." *Errors in Aiming.*—If several men fire with different rifles it is found that the vertical axis is greater than the one calculated as above, this is due to each man making use of a different amount of foresight; the difference between a full and a fine sight in the Mauser rifle has been found to cause an angular error in elevation of about twenty minutes. But experience has shown that men firing, even when making use of a rest in the lying down position, commit errors in aiming, of thirty minutes, this amount, therefore, must be added to that caused by differences in the rifle. In consequence, in order to obtain the vertical axis of the short group at 400 m., it is necessary to add to the dimensions given in Table 1, viz., 0·84 m., the maximum amount of error due to differences in the rifles, viz., $4 \times 0{\cdot}333 = 1{\cdot}333$ m.; the total 2·17 m. gives the vertical dispersion due to the arm: to this must be added the proximate amount of personal errors in aiming, viz., $4 \times 0{\cdot}873 = 3{\cdot}49$ m. (0·873 m. being the value of the natural tangent of 30 minutes at 100 m.), the grand total $2{\cdot}17 + 3{\cdot}49 = 5{\cdot}66$ is therefore the vertical axis of the shot group in collective fire at 400 m. These calculations are made in Table 20.

There is no need to calculate the breadth of these shot groups, as it is assumed that the front under fire depends on the extension given to the troops firing.

In Table 20 is also given the mean trajectory of the 1,600 m. sight extracted from Table G_2, G.M.I., and from this is calculated the upper and lower trajectory of the 1,600 m. gerbe by means of the addition to, or subtraction from it, of half the height of the shot groups at the several distances as shown in column 5 of the same table. In a similar manner the trajectories of the gerbes of all the lines of sight from 400 m. to 1,500 m. can be calculated.

The Depth of the Ground struck and of the Dangerous Ground as obtained by Calculation, compared with the Results derived from Experimental Firing.

The distinction between the terms dangerous zone and dangerous ground will be more clearly understood if reference is made to Diagram 5; in which the track of a gerbe, from its lower edge first touching a 6-foot target to its upper trajectory meeting the ground, is clearly indicated. This diagram, with regard to the "zone swept by the entire gerbe," applies chiefly to individual fire as beyond 600 m., the height of the shot groups exceeds that of the target.

Looking at Plate XXV, Fig. 5, and imagining that the line T_1G_1 is a straight line, then the angle T_1G_1T represents the angle of the drop of the bullet; and since T_1T equals half the depth of the gerbe at the extreme range of the sight used, and TG_1 equals half the extent of the ground struck: then the extent of the ground struck is equal to the vertical height of the shot group, corresponding to the distance of the sight employed, divided by the tangent of the angle of the drop at the same distance. For example, with the 900-m. gerbe the vertical height of the shot group at this distance is from Table 20, 14·63 m.; the angle of drop is 4° 20′, and its tangent is ·07578, consequently the extent of ground struck is $\frac{14{\cdot}63}{{\cdot}07578}$, or 193 m.

In Table 21 these calculations are made for all distances between 400 and 1,400 m.

If to the length of the ground struck is added the depth of the dangerous

zone, the extent of the dangerous ground is obtained. The depths of these "dangerous grounds" thus calculated are inserted in column 6 of Table 21, and by their side, in column 7, are placed the extent of the several dangerous grounds extracted from Table 14, "A," and obtained from direct experiment. The small differences which exist between the results obtained by either method, prove the correctness of the considerations which have formed the basis of the calculations. The mean depth of the dangerous ground as obtained by calculation is 226·8 m., and 228 m. as obtained from experimental firing, the average difference between these amounts being only 1·40 m.

The Reciprocal Action of the Causes which produce the Dispersion of the Shots.

If Table 20 be examined it will be seen that up to 1,000 m. the vertical dispersion due to errors in aiming exceeds the vertical dispersion due to the Mauser rifle, and that from 1,000 m. to 1,600 m. the reverse takes place. This shows that in estimating the value of different rifles it is not only necessary to compare the flatness of their trajectories and the accuracy of their shooting, but it is also necessary to compare the extent of the spread of the bullets when a dozen or more different rifles of the same pattern are made use of in collective fire. The pattern of rifle which, under these circumstances, gives rise to a denser and a more regular grouping of hits will be the best, and have the most destructive effect in the field. There is no method more searching for testing the value of different patterns of rifles than the rigid comparison of the series of terms obtained from long-continued collective firing.

Modification in the Series when the Conditions of the Firing are changed.

If the men, though still firing from a rest, are less skilful, and make errors in elevation in excess of 30′, the series will be lengthened, and the shots in the nucleus and in the adjoining screens will be less dense, and, further, the series will be less regular in character. By employing men still less skilful in firing all these irregularities will be accentuated, and it may happen that gaps will appear in the series in the neighbourhood of the distance corresponding to the sight in use.

When the firing takes place without rests the series is much lengthened and becomes irregular; the destructive effect of the gerbe ceasing in some places. These gaps are more numerous and nearer the distance corresponding to the sight in use in proportion as the inaccuracy of the firing increases. This proves the incorrectness of the statement, that collective fire is the negation of all musketry instruction. On the contrary, representative series show, by the modifications they undergo when deduced from the firing of bad shots, that the drilling and careful instruction of the soldier carries as much weight and has as much influence on collective fire as it has on individual fire. The skill of the firers is so much the greater as the record of their shooting gives a more regular, more continuous, and denser series. From this it follows that the collective fire of several men at a single target at distances over 400 m. is not the true gauge of their efficiency. It is necessary that they fire at a series of screens, which will register all the hits; then from their density an estimate of the value of their shooting can be obtained. The position of the nucleus offers no clue, as it does not depend on the efforts of the men, but on factors beyond their control.

Atmospheric conditions have their influence on firing; thus, temperature lower than 3° C. (the sight of the Mauser rifle is adjusted to 2·5° C.) would cause the series to be less dense than the normal one, while the series would become denser if the temperature rose above 3°; not taking into account, of course, the hygrometric state of the air. An atmosphere more or less warm has the effect of advancing or retiring a whole series with reference to its normal position. Between −3° and +3° a fall of one degree displaces the

series towards the firing point; about 4 m. at 100 m., 8 m. between 200 and 300 m., and 12 m. between 400 and 1,200 m. On the other hand, each rise of one degree between 3° and 16° removes the series further back: 2 m. between 0 and 300 m., and 4 m. between 400 and 1,200 m.

The deviations in the range of the bullets, due to the influence of temperature, are similar to the deviations due to errors in aiming, nearly constant, and diminish instead of increasing at distances beyond 1,200 m. The hygrometric state of the air sometimes counterbalances this increase of range, as it has been found that, when the ground is much heated by the sun, the most densely saturated layer of air is at a certain distance above the ground; and, consequently, acts as a retarding force more powerfully on the high trajectories than on the lower ones. With a temperature of 15° C. (58·5° F.) the shot groups of the Mauser rifle will be displaced 48 m. away from the firing point, if the firing is at 400 yards. But as at this distance aiming at the foot of the target has the effect of bringing the nucleus 35 m. towards the firing point, the deviation in range caused by an elevation in temperature, approximating to the mean temperature of Central Europe, is compensated up to 700 m. by the practice of aiming at the foot of an object.

Modifications caused in the Series by the Ground on which the Objective rests, rising or falling with reference to the Line of Sight.

The next point to consider is, how the dispersion of the bullets is affected by the slope of the ground on which they fall. Mathematical proof need not be given to show that when ground rises with reference to the line of sight, the extent of the ground struck is diminished, and that the contrary takes place when the ground falls; nor to prove the corollary that the density of the hits is increased in the first case and diminished in the second.

Still the length of the dangerous ground under all circumstances requires to be known, and therefore the following calculations must be made:—Let G represent the vertical axis of the shot group in collective firing at any selected distance, a the angle of the normal drop of the bullet at this same distance, and a' the angle of the actual drop of the bullet on a surface inclined with reference to the line of sight; let x equal the interval which must exist between the terms of the new series—bearing in mind that the intervals in the normal series are 10 metres—and n represent the number of terms in each series; then, since the extent of the dangerous ground is equal to the depth of the ground struck, added to the depth of the dangerous zone, the following equations are arrived at:—

$$10\,n = \frac{G}{\text{Tan } a} + \frac{1{\cdot}8^\circ}{\text{Tan } a} = \frac{G + 1{\cdot}8^\circ}{\text{Tan } a}$$

$$n\,x = \frac{G}{\text{Tan } a'} + \frac{1{\cdot}8^\circ}{\text{Tan } a'} = \frac{G + 1{\cdot}8^\circ}{\text{Tan } a'}$$

for $\frac{G}{\text{Tan } a}$ = and $\frac{G}{\text{Tan } a'}$ represent the ground struck

and $\frac{1{\cdot}8^\circ}{\text{Tan } a}$ and $\frac{1{\cdot}8^\circ}{\text{Tan } a'}$ the extent of the dangerous zone.

$$\text{then } \frac{x}{10} = \frac{\text{Tan } a}{\text{Tan } a'} \text{ and } x = \frac{10 \text{ Tan } a}{\text{Tan } a'}$$

Substituting the value of x for the 10 m. in the normal series and multiplying by the number of terms in the same series, the extent of the dangerous

ground can be obtained for all slopes and at all distances. The preceding calculations must not be thought to be applicable on the field of battle where tactical considerations are dominant, but still they serve their purpose by pointing out how the slopes of ground affect the destructive action of collective fire, and from this information serviceable tactical rules can be deduced.

In Table 22 the reduction in length of the normal 10 m. intervals are shown for distances between 400 and 1,600 m., and when the ground rises respectively 3°, 5°, or 10°. The following examples will show how the calculations have been made.

Example.—Find the length of the interval which separates the different terms of the 400 m. line of sight when firing at an object on an ascending slope of 3°.

In Appendix G_3, G.M.I. of 1877, the normal angle of the drop of a bullet at 400 m. is stated to be 1° 8′ 16″; for all practical purposes 1° 10′ is sufficiently near. The actual angle of the drop of a bullet when the ground on which the bullet falls rises with reference to the line of sight is equal to the normal angle of drop added to the angle which the slope of the ground makes with the line of sight; and when the ground falls, to the normal angle of drop diminished by the angle formed by the slope of the ground and the line of sight. Applying the above data and calling x the reduced interval required, we have from the preceding equation—

$$\frac{x}{10} = \frac{\text{Tan } 1° 10'}{\text{Tan } 4° 10'} = \frac{\cdot 02037}{\cdot 07286}$$

$$\text{and } x = \frac{\cdot 2037}{\cdot 07286} = 3 \text{ m.}$$

If Table 22 be examined, it will be seen that when firing at an object on an ascending slope, the normal extent of the dangerous ground, and in consequence the extent of the ground struck by all the bullets in the gerbe, is diminished by one-half; at 800 m., when the slope is 5°, at 1,000 m. when the slope is 5°, and at 1,500 m. when it is 10°.

Depth of the Effective Dangerous Ground when the Surface on which the Bullets fall is not parallel to the Line of Sight.

It has been said before that when the value of the interval of a series derived from collective fire at an object on a slope has been obtained, it is easy to calculate the corresponding extent of the effective dangerous ground, but an example may make this clearer.

Example.—Find the length of the dangerous ground at 600 m. when the ground which receives the bullets makes an ascending angle of 5° with the line of sight. Referring to Table 14, "A," it will be seen that the extent of the normal effective dangerous ground with the 600 m. sight is 170 m., and that it contains seventeen terms. Looking at Table 22, the length of each term of the series with the 600 m. sight, when employed against a slope of 5°, will be found to be 3 m.; consequently the effective dangerous ground is 17×3 or 51 m.; thus the effect of firing against a slope of 5° is at 700 m. to reduce the effective dangerous ground from 170 m. to 51 m.

Table 23 contrasts the extent of the effective dangerous ground when fire is directed on an ascending slope with its extent when the fire takes place on a plane. It may be observed that the mean length of the effective dangerous ground at distances between 400 m. and 1,400 m. is 134 m., and that for the slopes of 3°, 5°, 10°, its mean length is reduced respectively to 70, 54, and 30 m.; in other words, when fire is directed at ascending slopes forming angles of 3°, 5°, or 10° with the line of sight, the effective dangerous ground is approximately one-half, one-third, or one-fourth the length of the effective dangerous

ground under normal circumstances; and, similarly, when the bullets fall on descending slopes, making angles of 3°, 5°, or 10° with the line of sight, the extent of the effective dangerous ground is approximately double, treble, or quadruple the length of the normal effective dangerous ground.

Tactical Considerations.

Before concluding it may be pointed out how the foregoing study may be utilized with reference to tactical questions; for instance, the length of the dangerous ground in the different series serves to determine the distances which should separate the different échelons during an attack or when on the defensive. It is clear that the placing two lines under the influence of same gerbe is to be avoided whenever it is possible; but since the extent of the dangerous ground increases the nearer the enemy is approached, the paradox is arrived at, that the nearer the front line is to the enemy the further the supports should be from it. This difficulty is met by placing as many rifles as possible in the front line of the attack from its very commencement, and by keeping the supports about 500 yards in rear, and thus clear of the fire directed at the front line. Under these circumstances, the strong front line would be able to push rapidly and energetically forward until checked by some serious opposition. During this halt, and while preparing for a further advance by trying to dominate the enemy's fire, the front line would be strong enough, if a counter-attack were made, to hold it in check sufficiently long to give time for the supports to come up. The supports, if not thus required, would remain outside the influence of the fire aimed at the front line until the losses in it necessitated its being reinforced.

Again, a study of the series helps to show the relative amount of losses due to different formations at different periods of an action. Thus in the German Musketry Instructions it is stated, that a standing company column up to 700 m. suffers little more loss than a line, but beyond this distance, and up to 1,600 m., its losses are more than double those of a line; while a company column lying down must expect losses double or treble those of a line lying down.

A consideration of the data connected with the influence of slopes on the dispersion of bullets, leads to the conclusion, that when the ground on which the objective rests, makes an ascending angle of over 3° with the line of sight, it is advisable to make use of a combination of two sights, and to employ three sights, if the slopes be steeper still. Whereas, if the ground slopes away from the line of sight, one sight only should be made use of.

The study of the blending of gerbes when two or more sights are made use of leads to the impression that a single line of men cannot give full effect to the deadly power of long-ranging rifle-fire; hence arises the idea of double tier fire, or the firing of one line of men over the heads of another line at the same object: possibly to be realized on the defensive on some prominent spur commanding and flanking the enemy's line of approach; possibly, if time admits, in a skilful arrangement of shelter trenches, and, lastly, to be carried out in earthworks intended to act as supports in a position, or as an outer line of defence around some important village or town.

Before quitting this part of the subject a few words must be said as to the method of employing collective fire in the field. Looking at its mode of action, viz., the simultaneous discharge of many rifles at the same object, its effect may be likened to that of a blow; hence, like a blow, it must be delivered with rapidity; the number of rounds allotted to it must be discharged at the same time; a pause would then take place, the smoke would be allowed to clear off, the men's nerves would become steadied, and then, if required, another blow could be struck; or, a certain number of blows might be given rapidly, one after the other. The suddenness with which such fire

would be delivered, and its intermittent nature, would have a moral effect on the enemy ; it would create a feeling of suspense, and prevent the nerves of the men getting accustomed to the ping of the bullets. Further, as collective fire should not be carried out by a less number of men than 100, its employment, as a rule, should be directed by a battalion commander ; and in his hands it is probable that no waste of ammunition would be permitted, as the objective would be well selected, its distance fairly estimated, and the result of the fire carefully studied.

Conclusion.

Having travelled over many paths, branching one from the other, it may be well, in conclusion, briefly to summarize what are the salient features connected with the combination of two or more sights in collective fire. The advantages claimed for this system of firing at all distances beyond the limits of individual fire, fixed at 400 m. for the Mauser rifle, are—that it counterbalances the loss of effect in rifle-fire due to moving objectives, errors in judging distances, deviations caused by atmospheric influences, and the shortening of the dangerous ground resulting from the surface on which the bullets fall not being parallel to the line of sight. The mere statement of these facts brings at once to mind the number of situations in war where the employment of this kind of fire would have a marked influence on the fortunes of the day ; and no more important tactical problem awaits the test of practical experience than that of how best to utilize collective fire on the field. The plan must be thought out in peace-time, and practised in war ; not to make use of the full power of the infantry rifle is like asking a man to defend himself with one hand tied behind his back. Whatever power is latent in rifle-fire must be drawn out, and no impediment should be placed in the way of obtaining the necessary data on which to formulate a decision.

And now, at the conclusion of this paper, as at its commencement, my indebtedness to the articles in the "Revue Militaire de l'Étranger," on the German Musketry Instructions, must again be acknowledged ; tables have been bodily extracted from them, entire paragraphs have been copiously used, and arguments and deductions freely borrowed. Thus my paper lays no claim to originality, but is merely a critical collection and arrangement of data connected with rifle-fire ; useful perchance at this time, when all Officers are studying the theory as well as the practice of musketry.

Table 1.

Dimensions of the shot groups of the Mauser rifle.

Distances.	Major-axis.	Minor-axis.	Per cent. of abnormal hits deducted from those taken off.	Remarks.
m.	m.	m.	per cent.	
100	0·16	0·16	1	
150	0·24	0·24	2	The size of a man's head.
200	0·34	0·32	3	
250	0·44	0·40	4	The breadth of a man.
300	0·58	0·48	5	A little broader than a man.
350	0·68	0·58	6	
400	0·84	0·68	7	
500	1·18	0·96	8	A little broader than a group of two men.
600	1·58	1·26	9	The height of a 5 ft. 3 in. standing man.
700	2·12	1·68	10	
800	2·80	2·12	11	
900	3·78	2·64	12	More than twice the height and six times the breadth of a standing man.
1000	4·74	3·24	13	
1100	6·06	3·88	14	
1200	7·60	4·60	15	
1300	9·64	5·34	16	
1400	12·12	6·12	17	
1500	15·12	6·96	18	It is necessary to place eight targets 1·8 m. high and 6·9 m. wide at 10 m. from each other in order to intercept 82 per cent. of the hits.
1600	18·72	78·6	19	It is necessary to place ten targets 1·80 m. high and 7·86 m. wide at 9 m. apart in order to intercept 81 per cent. of the hits.

Table 2.

Sights.	Ordinates in metres of the mean trajectory of the Mauser rifle, pattern 1871, above or below the horizontal line of sight, and at distances in metres of—																
	25	50	75	100	125	150	175	200	225	250	270	300	325	350	375	400	425
Fixed 270 m.	+0·21	+0·39	+0·53	+0·62	+0·68	+0·69	+0·65	+0·55	+0·40	+0·19	±0	−0·42	−0·83	−1·30	—	—	—
Flap 350 m.	+0·30	+0·57	+0·80	+1·00	+1·14	+1·25	+1·29	+1·29	+1·24	+1·12	+0·94	+0·70	+0·39	±0	−0·46	−0·99	—
400 m. ..	+0·37	+0·70	+0·99	+1·24	+1·46	+1·62	+1·73	+1·79	+1·80	+1·74	+1·63	+1·41	+1·19	+0·87	+0·47	±0	−0·55

Table 3.

Ordinates of the upper and lower trajectories of the 350 m. gerbe above a horizontal plane, or one sensibly parallel to the line of sight, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target at the several distances named below.

Distances.	Upper trajectory.		Lower trajectory.	
	Foot of the target.	Centre of the target.	Foot of the target.	Centre of the target.
Metres.	m. c.	m. c.	m. c.	m. c.
50.....	0 61	1 51	0 53	1 43
100.....	1 08	1 98	0 92	1 82
150.....	1 37	2 20	1 13	2 03
200.....	1 46	2 36	1 12	2 02
250.....	1 34	2 24	0 90	1 80
300.....	0 99	1 89	0 41	1 31
350.....	0 34	1 24	0 34	0 56

Table 4.

Ordinates, at intervals of 50 m. above a horizontal plane, of the 350 m. line of sight, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.

Distances corresponding to the ordinates.	Aim directed at the foot of target at 350 m.			Aim directed at the centre of a target at 350 m.		
	Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
..	1 50	0 90	0 30	1 50	0 90	0 30
50.....	1 28	0 77	0 25	1 40	0 90	0 38
100.....	1 07	0 64	0 21	1 32	0 90	0 47
150.....	0 85	0 51	0 17	1 24	0 90	0 55
200.....	0 64	0 38	0 12	1 14	0 90	0 64
250.....	0 42	0 25	0 08	1 06	0 90	0 73
300.....	0 21	0 12	0 04	0 98	0 90	0 81
350.....	..	..	..	0 90	0 90	0 90

Table 5.

Distances corresponding to the ordinates.	Ordinates, at intervals of 50 m. above a horizontal plane, of the mean trajectory of the 350 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of target.						Ordinates of ricochets proceeding from the mean trajectory of the 350 m. gerbe.		
	Aim directed at the foot of a target at 350 m.			Aim directed at the centre of a target at 350 m.			Aim directed at the foot of a target at 350 m.		
	Firing.			Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling	Lying down.
Metres.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
..	1 50	0 90	0 30	1 50	0 90	0 30			
50	1 85	1 34	0 82	1 97	1 47	0 95			
100	2 07	1 64	1 21	2 32	1 90	1 47			
150	2 10	1 76	1 42	2 49	2 15	1 80			
200	1 93	1 67	1 41	2 43	2 19	1 93			
250	1 54	1 37	1 20	2 20	2 02	1 85			
300	0 91	0 82	0 74	1 68	1 60	1 51			
350	..	..	..	0 90	0 90	0 90			
360	..	..	..	..	..	..	0 36	0 33	0 30
380	..	..	..	..	..	..	1 00	0 98	0 89
400	..	..	..	..	..	..	1 82	1 64	1 48

Table 6.

Distances corresponding to the ordinates.	Ordinates, at intervals of 50 m. and above a horizontal plane, of the upper trajectory of the 350 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.						Ordinates of ricochets proceeding from the upper trajectory of the 350 m. gerbe.		
	Aim directed at the foot of a target at 350 m.			Aim directed at the centre of a target at 350 m.			Aim directed at the foot of a target at 350 m.		
	Firing.			Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
..	1 50	0 90	0 30	1 50	0 90	0 30			
50	1 89	1 38	0 86	2 01	1 51	0 99			
100	2 15	1 72	1 29	2 40	1 98	1 55			
150	2 22	1 88	1 54	2 61	2 27	1 92			
200	2 10	1 84	1 58	2 60	2 36	2 10			
250	1 76	1 59	1 42	2 42	2 24	2 07			
300	1 20	1 11	1 03	1 97	1 89	1 80			
350	0 34	0 34	0 34	1 24	1 24	1 24			
360	0 17	0 18	0 18	..	..	..			
380	..	..	..	..	..	..	0 34	0 24	0 16
400	..	..	..	..	..	..	1 02	0 86	0 36

Table 7.

Distances corresponding to the ordinates.	Ordinates, at intervals of 50 m. and above a horizontal plane, of the lower trajectory of the 350 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.						Ordinates of ricochets proceeding from the lower trajectory of the 350 m. gerbe.		
	Aim directed at the foot of a target at 350 m.			Aim directed at the centre of a target at 350 m.			Aim directed at the foot of a target at 350 m.		
	Firing.			Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres. ..	m. c. 1 50	m. c. 0 90	m. c. 0 30	m. c. 1 50	m. c. 0 90	m. c. 0 30	m. c.	m. c.	m. c.
50	1 81	1 30	0 78	1 93	1 43	0 91			
100	1 99	1 56	1 13	2 24	1 82	1 39			
150	1 98	1 54	1 30	2 37	2 03	1 68			
200	1 76	1 50	1 24	2 26	2 02	1 76			
250	1 32	1 15	0 98	1 98	1 80	1 63			
300	0 62	0 53	0 45	1 39	1 31	1 22			
350	−0 34	−0 34	−0 34	0 56	0 56	0 56	0 68	0 68	0 68
360	..	..	..	..	..	..	1 06	1 02	0 99
380	..	..	..	..	..	..	1 81	1 70	1 61
400	..	..	..	..	..	..	2 57	2 38	2 22

Table 8.

Ordinates, at intervals of 50 m. and above a horizontal plane, of the 270 m. line of sight, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.

Distances corresponding to the ordinates.	Aim directed at the foot of a target at 270 m.			Aim directed at the centre of a target at 270 m.		
	Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
..	1 50	0 90	0 30	1 50	0 90	0 30
50	1 22	0 73	0 24	1 39	0 90	0 42
100	0 95	0 57	0 19	1 28	0 90	0 53
150	0 67	0 40	0 13	1 17	0 90	0 64
200	0 39	0 23	0 08	1 06	0 90	0 75
250	0 11	0 07	0 02	0 94	0 90	0 87
270	..	..	..	0 90	0 90	0 90

Table 9.

Distances corresponding to the ordinates.	Ordinates, at intervals of 50 m. and above a horizontal plane, of the mean trajectory of 270 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.						Ordinates of ricochets proceeding from the mean trajectory of the 270 m. gerbe.		
	Aim directed at the foot of a target at 270 m.			Aim directed at the centre of a target at 270 m.			Aim directed at the foot of a target at 270 m.		
	Firing.			Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
..	1 50	0 90	0 30	1 50	0 90	0 30			
50	1 51	1 12	0 63	1 78	1 29	0 81			
100	1 57	1 19	0 81	1 90	1 52	1 15			
150	1 36	1 09	0 82	1 86	1 59	1 33			
200	0 94	0 78	0 63	1 61	1 45	1 30			
250	0 30	0 26	0 21	1 13	1 09	1 06			
270	..	..	..	0 90	0 90	0 90			
300	..	..	..	..	..	..	0 90	0 78	0 63
330	..	..	..	..	..	..	1 80	1 56	1 26

Table 10.

Distances corresponding to the ordinates.	Ordinates, at intervals of 50 m. and above a horizontal plane, of the upper trajectory of the 270 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.						Ordinates of ricochets proceeding from the upper trajectory of the 270 m. gerbe.		
	Aim directed at the foot of a target at 270 m.			Aim directed at the centre of a target at 270 m.			Aim directed at the foot of a target at 270 m.		
	Firing.			Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
..	1 50	0 90	0 30	1 50	0 90	0 30			
50	1 55	1 16	0 67	1 82	1 33	0 85			
100	1 65	1 27	0 89	1 98	1 60	1 23			
150	1 48	1 21	0 94	1 98	1 71	1 45			
200	1 11	0 95	0 80	1 78	1 62	1 47			
250	0 52	0 48	0 43	1 35	1 31	1 28			
270	0 25	0 25	0 25	1 15	1 15	1 15			
300	..	..	..	..	..	..	0 32	0 18	0 04
330	..	..	..	..	..	..	1 15	0 87	0 57

Table 11.

Distances corresponding to the ordinates.	Ordinates, at intervals of 50 m. and above a horizontal plane, of the lower trajectory of the 270 m. gerbe, according as the firer is standing, kneeling, or lying down, and aim taken at the foot or centre of the target.						Ordinates of ricochets proceeding from the upper trajectory of the 270 m. gerbe.		
	Aim directed at the foot of a target at 270 m.			Aim directed at the centre of a target at 270 m.			Aim directed at the foot of a target at 270 m.		
	Firing.			Firing.			Firing.		
	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.	Standing.	Kneeling.	Lying down.
Metres.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.	m. c.
..	1 50	0 90	0 30	1 50	0 90	0 30			
50	1 47	1 08	0 59	1 74	1 25	0 77			
100	1 49	1 11	0 73	1 82	1 44	1 07			
150	1 24	0 97	0 70	1 74	1 47	1 21			
200	0 77	0 61	0 46	1 44	1 28	1 13			
250	0 08	0 04	−0 01	0 91	0 87	0 84			
270	−0 25	−0 25	−0 25	0 65	0 65	0 65	0 50	0 50	0 50
300	..	..	..	..	..	..	1 50	1 38	1 29
330	..	..	..	..	..	..	2 50	2 26	2 08

Table 12.

An approximate comparison between the zone swept by the entire gerbe and the probable errors made in judging distance in the field.

Distances.	Zone swept by entire gerbe.	Probable error in judging distance.
Metres.	Metres.	Metres.
400	106	57
450	62	64
500	21	71
600	5	85

Table 13.

Intervals between the experimental targets deduced from the theoretical dangerous zones or "margins."

Number of the target.	Distance from the firing-point.	Number of the target.	Distance from the firing-point.	Number of the target.	Distance from the firing-point.	Number of the target.	Distance from the firing-point.
	Metres.		Metres.		Metres.		Metres.
1	300	20	1015·4	39	1313·3	58	1526·4
2	400	21	1034·4	40	1362·2	59	1536·3
3	475	22	1052·9	41	1338·9	60	1546·1
4	535	23	1070·9	42	1351·4	61	1555·8
5	585·8	24	1088·4	43	1363·7	62	1565·5
6	629·1	25	1105·9	44	1375·7	63	1575·2
7	669·1	26	1122·9	45	1387·5	64	1584·8
8	706·1	27	1139·5	46	1399·2	65	1594·3
9	742·1	28	1155·7	47	1410·7	66	1603·8
10	775·6	29	1171·5	48	1422	67	1613·3
11	806·1	30	1186·9	49	1433·1	68	1622·7
12	834·5	31	1201·9	50	1444·2	69	1632
13	860·3	32	1216·7	51	1455	70	1641·3
14	884·5	33	1231·2	52	1465·6	71	1650·6
15	908·7	34	1245·5	53	1476·1	72	1659·8
16	931·8	35	1259·5	54	1486·4	73	1668·9
17	953·9	36	1273·3	55	1496·6	74	1677·9
18	975	37	1286·9	56	1506·6	75	1686·8
19	996	38	1300·2	57	1516·5		

Table 17.

Series with a combination of two sights.

Distances.	Series in the German Musketry Instructions.			Series carried 20 m. towards firing point.[1]			Remarks.
	600 m. sight.	700 m. sight.	Combined 600 and 700 m. sights.	600 m. sight.	700 m. sight.	Combined 600 and 700 m. sights.	
Metres.	100 rnds.	100 rnds.	200 rnds.	100 rnds.	100 rnds.	200 rnds.	
440	..	..	..	..	..	..	The parts of the series printed in large figures represent the effective dangerous zones, in which 10 or more hits are counted on each screen.
450	..	..	..	1	..	1	
460	..	..	..	4	..	4	
470	1	..	1	4	..	4	
480	4	..	4	4	..	4	
490	4	..	4	11	..	11	
500	4	..	4	17	..	17	
510	11	..	11	21	..	21	
520	17	..	17	23	..	23	
530	21	..	21	25	..	25	
540	23	..	23	35	..	35	
550	25	..	25	49	..	49	
560	35	..	35	48	..	48	[1] True position of the series, see remarks in para. "C" in "Observations on the series obtained from the use of one sight."
570	49	..	49	49	..	49	
580	48	..	48	52	3	55	
590	49	..	49	51	4	55	
600	52	3	55	47	6	53	
610	51	4	55	34	7	41	
620	47	6	53	31	14	45	
630	34	7	41	24	15	39	
640	31	14	45	24	19	43	
650	24	15	39	16	26	42	
660	24	19	43	11	26	37	
670	16	26	42	5	29	34	
680	11	26	37	3	35	38	
690	5	29	34	..	28	28	
700	3	35	38	1	33	34	
710	..	28	28	2	32	34	
720	1	33	34	2	26	28	
730	2	32	34	2	29	31	
740	2	26	28	1	17	18	
750	2	29	31	..	13	13	
760	1	17	18	..	6	6	
770	..	13	13	..	3	3	
780	..	6	6	..	4	4	
790	..	3	3	..	5	5	
800	..	4	4	..	4	4	
810	..	5	5	..	4	4	
820	..	4	4	..	3	3	
830	..	4	4	..	2	2	
840	..	3	3	..	2	2	
850	..	2	2	..	..	..	
860	..	2	2	..	..	..	
870	..	..	..	..	..	..	

Table 17.

Series with a combination of two sights.

Distances.	Series in the German Musketry Instructions.			Series carried 20 m. towards firing point.[1]			Remarks.
	600 m. sight.	700 m. sight.	Combined 600 and 700 m. sights.	600 m. sight.	700 m. sight.	Combined 600 and 700 m. sights.	
Metres.	100 rnds.	100 rnds.	200 rnds.	100 rnds.	100 rnds.	200 rnds.	
440	..	..	..	..	..	..	The parts of the series printed in large figures represent the effective dangerous zones, in which 10 or more hits are counted on each screen.
450	..	..	..	1	..	1	
460	..	..	..	4	..	4	
470	1	..	1	4	..	4	
480	4	..	4	4	..	4	
490	4	..	4	11	..	11	
500	4	..	4	17	..	17	
510	11	..	11	21	..	21	
520	17	..	17	23	..	23	
530	21	..	21	25	..	25	
540	23	..	23	35	..	35	
550	25	..	25	49	..	49	
560	35	..	35	48	..	48	[1] True position of the series, see remarks in para. "C" in "Observations on the series obtained from the use of one sight."
570	49	..	49	49	..	49	
580	48	..	48	52	3	55	
590	49	..	49	51	4	55	
600	52	3	55	47	6	53	
610	51	4	55	34	7	41	
620	47	6	53	31	14	45	
630	34	7	41	24	15	39	
640	31	14	45	24	19	43	
650	24	15	39	16	26	42	
660	24	19	43	11	26	37	
670	16	26	42	5	29	34	
680	11	26	37	3	35	38	
690	5	29	34	..	28	28	
700	3	35	38	1	33	34	
710	..	28	28	2	32	34	
720	1	33	34	2	26	28	
730	2	32	34	2	29	31	
740	2	26	28	1	17	18	
750	2	29	31	..	13	13	
760	1	17	18	..	6	6	
770	..	13	13	..	3	3	
780	..	6	6	..	4	4	
790	..	3	3	..	5	5	
800	..	4	4	..	4	4	
810	..	5	5	..	4	4	
820	..	4	4	..	3	3	
830	..	4	4	..	2	2	
840	..	3	3	..	2	2	
850	..	2	2	..	..	..	
860	..	2	2	..	..	..	
870	..	..	..	..	..	..	

Table 14.

"A."

SERIES OBTAINED WITH ONE SIGHT AGA

The men fired lying down with their rifles supported on a rest. T

Back sight adjusted for	No. of rounds.	Targets representing	Targets in front of nucleus, distances in metres.																	
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30
400 m.	100	Company in line	4	5	5	7	9	9	10	12	14	15	18	24	26	30	44	53	60	64
		,, column	5	6	7	9	10	10	12	14	16	24	24	31	44	55	62	66	74	73
500 m.	100	,, line							3	4	6	6	7	9	19	25	30	30	36	41
		,, column							4	6	7	9	19	25	30	34	39	45	51	60
600 m.	100	,, line								1	4	4	4	11	17	21	23	25	35	49
		,, column								4	4	10	16	22	21	27	37	45	56	63
700 m.	100	,, line											3	4	6	7	14	15	19	26
		,, column											5	7	14	16	20	26	33	36
800 m.	100	,, line										3	3	4	4	9	12	13	15	19
		,, column										5	5	6	11	14	13	23	25	29
900 m.	100	,, line									1	1	1	.	.	.	1	6	10	12
		,, column									1	2	2	3	4	6	10	16	26	34
1000 m.	100	,, line									1	3	2	3	4	3	4	13	18	14
		,, column								1	3	5	5	4	6	8	18	24	26	20
1100 m.	100	,, line											1	3	4	4	6	11	13	9
		,, column											4	6	8	11	13	12	17	14
1200 m.	100	,, line											2	3	.	1	2	2	6	12
		,, column											3	3	1	3	5	11	19	24
1300 m.	100	,, line											3	2	2	1	5	4	6	10
		,, column											5	4	5	7	11	12	18	18
1400 m.	100	,, line										1	.	.	3	2	4	4	2	3
		,, column										1	1	3	5	8	7	6	5	11

"B."

SERIES OBTAINED WITH ONE SIGHT AGAI

Targets 20 metres wide, 0·45 met

400 m.	200	Company in line							1	.	.	4	6	11	17	28	29	24	34	38
		,, column							1	1	5	7	16	29	40	44	55	56	51	57
500 m.	200	,, line							1	2	2	1	.	.	.	1	2	5	5	9
		,, column							1	2	2	1	.	.	2	3	5	10	20	36
600 m.	200	,, line										2	2	2	7	11	17	23	26	14
		,, column										4	9	14	22	32	43	41	45	41
700 m.	200	,, line												3	4	4	13	12	17	16
		,, column												7	16	22	31	37	40	33
800 m.	200	,, line						1	.	3	2	.	1	2	1	2	4	2	4	8
		,, column		1	1	.	1	1	3	5	2	3	3	4	5	7	9	12	22	33
900 m.	200	,, line											1	.	1	.	2	2	2	6
		,, column											1	1	2	4	6	8	12	22
1000 m.	200	,, line													1	2	4	2	4	5
		,, column													5	7	6	7	21	28
1100 m.	200	,, line												1	2	.	2	1	.	3
		,, column											3	4	5	5	8	10	16	17
1200 m.	200	,, line												3	1	3	1	3	5	9
		,, column												5	6	5	4	12	20	19
1300 m.	200	,, line												1	2	3	3	2	4	6
		,, column											1	3	5	12	8	6	12	14
1400 m.	200	,, line													1	1	2	3	5	8
		,, column													2	7	9	10	20	19

N.B.—To turn metres into yards add one-tenth. Ex.—10
To turn yards into metres deduct one-tenth. Ex.—10

ible 14.

" A."

SIGHT AGAINST MEN STANDING.

d on a rest. Targets 20 metres wide, 1·80 metres high.

					Nucleus or mean centre of impact.	Targets in rear of nucleus, distances in metres.																				
0	40	30	20	10		10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210
					Number of hits excluding ricochets.																					
3	60	64	70	68	71	61	61	57	36	29	21	16	9	8	4	5	5	6	6	5	4	3	3	2	2	1
6	74	73	79	77	77	68	66	57	37	31	22	17	12	11	5	7	7	6	6	6	4	3	4	2	2	1
9	36	41	51	56	64	58	50	44	37	27	17	13	14	13	14	14	13	8	7	4	3					
5	51	60	69	71	68	59	52	47	39	33	23	16	15	16	17	17	13	8	7	4	3					
5	35	49	48	49	52	51	47	34	31	24	24	16	11	5	3	.	1	2	2	2	1					
5	56	63	62	56	62	64	52	42	37	29	25	16	11	5	4	2	2	2	2	2	1					
5	19	26	26	29	35	28	33	32	26	29	17	13	6	3	4	5	4	4	3	2	2					
5	33	36	39	42	45	40	39	41	32	30	18	15	10	7	6	6	6	5	3	2	2					
3	15	19	24	24	31	27	29	23	19	14	8	5	3	1	2	1	1									
3	25	29	37	40	42	41	39	30	21	17	9	6	4	2	2	1	1									
	10	12	14	24	31	28	23	22	19	13	7	5	6	5	3	1	2									
6	26	34	38	42	42	38	29	25	23	14	11	7	7	6	4	2	2									
3	18	14	9	15	27	26	13	5	7	9	10	3	1													
4	26	20	27	38	42	31	17	11	18	15	11	4	1													
2	13	9	7	17	18	17	14	12	15	11	5	2	.	2	1											
2	17	14	19	24	29	29	23	25	20	15	6	3	2	2	1											
	6	12	13	15	22	14	10	6	7	2	.	1	2	2	1	1						1				
	19	24	31	34	35	22	15	12	9	3	2	3	3	3	2	1										
	6	10	8	8	14	7	10	8	6	3	2	.	1	1												
2	18	18	32	19	22	17	19	12	11	5	2	2	3	1												
	2	3	8	10	11	10	9	17	9	4	.	1														
	5	11	21	26	22	24	25	25	13	4	1	1														

" B."

IGHT AGAINST MEN LYING DOWN.

wide, 0·45 metre high.

4	34	38	15	30	47	42	31	14	13	12	6	6	6	5	6	3	.	1	.	1				1		
6	51	57	55	61	74	56	44	27	23	17	11	11	12	11	8	4	1									
	5	9	22	40	41	32	28	20	26	19	14	13	11	11	10	10	5	3	2	1	1	3	.	1	2	1
9	20	36	51	63	63	52	53	45	39	32	24	24	22	21	20	16	9	6	4	3	4	4	3	4	3	1
3	26	14	22	20	29	23	17	10	7	6	5	4	3	5	2	2	.	1	1	1						
	45	41	49	52	57	43	29	18	13	11	11	11	10	9	4	2	2	3	3	3						
	17	16	13	13	27	22	12	7	13	6	2	1	2	.	.	1	.	1								
	40	33	32	49	54	40	29	29	22	9	6	4	2	.	1	1	.	1								
	4	8	16	16	19	7	10	10	4	4	5	3	1	.	.	1	1	2	.	.	.	.	1	.	.	2
	22	33	36	38	34	28	25	16	9	11	8	7	7	3	1	6	4	3	1	.	.	.	3	1	2	4
	2	6	8	9	14	13	10	14	4	2	6	2	1	.	2											
	12	22	37	33	35	37	30	27	12	11	16	6	4	2	2											
	4	5	11	8	8	4	9	7	8	1	3	7	3	.	1	1										
	21	28	33	26	23	23	19	22	24	13	10	11	4	2	3	2										
	.	3	6	13	13	6	5	8	8	4	2	1	2	.	1											
	16	17	20	29	29	18	23	25	14	9	5	4	3	.	2											
	5	9	6	7	10	4	7	2	6	1	1															
	20	19	27	17	28	12	14	5	7	2	1															
	4	6	3	3	7	5	2	5	1	3	1															
	12	14	7	13	17	12	9	11	9	8	3	3	1													
	5	8	7	7	8	4	3	6	2	2	.	2	.	1												
	20	19	14	16	16	7	9	12	2	4	4	4	.	1	2											

enth. Ex.—100 m. $=100+\frac{100}{10}=110$ yds.

ne-tenth. Ex.—100 yds. $=100-\frac{100}{10}=90$ m.

Table 14.

"A."

SERIES OBTAINED WITH ONE SIGHT AGA

The men fired lying down with their rifles supported on a rest. T

Back sight adjusted for	No. of rounds.	Targets representing	Targets in front of nucleus, distances in metres.																	
			200	190	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30
400 m.	100	Company in line	4	5	5	7	9	9	10	12	14	15	18	24	26	30	44	53	60	64
		,, column	5	6	7	9	10	10	12	14	16	24	24	31	44	55	62	66	74	73
500 m.	100	,, line							3	4	6	6	7	9	19	25	30	30	36	41
		,, column							4	6	7	9	19	25	30	34	39	45	51	60
600 m.	100	,, line								1	4	4	4	11	17	21	23	25	35	49
		,, column								4	4	10	16	22	21	27	37	45	56	63
700 m.	100	,, line											3	4	6	7	14	15	19	26
		,, column											5	7	14	16	20	26	33	36
800 m.	100	,, line										3	3	4	4	9	12	13	15	19
		,, column										5	5	6	11	14	13	23	25	29
900 m.	100	,, line									1	1	1	.	.	.	1	6	10	12
		,, column									1	2	2	3	4	6	10	16	26	34
1000 m.	100	,, line									1	3	2	3	4	3	4	13	18	14
		,, column								1	3	5	5	4	6	8	18	24	26	20
1100 m.	100	,, line											1	3	4	4	6	11	13	9
		,, column											4	6	8	11	13	12	17	14
1200 m.	100	,, line											2	3	.	1	2	2	6	12
		,, column											3	3	1	3	5	11	19	24
1300 m.	100	,, line											3	2	2	1	5	4	6	10
		,, column											5	4	5	7	11	12	18	18
1400 m.	100	,, line										1	.	.	3	2	4	4	2	3
		,, column										1	1	3	5	8	7	6	5	11

"B."

SERIES OBTAINED WITH ONE SIGHT AGAIN

Targets 20 metres wide, 0·45 metr

400 m.	200	Company in line							1	.	.	4	6	11	17	28	29	24	34	38
		,, column							1	1	5	7	16	29	40	44	55	56	51	57
500 m.	200	,, line							1	2	2	1	.	.	.	1	2	5	5	9
		,, column							1	2	2	1	.	.	2	3	5	10	20	36
600 m.	200	,, line										2	2	2	7	11	17	23	26	14
		,, column										4	9	14	22	32	43	41	45	41
700 m.	200	,, line												3	4	4	13	12	17	16
		,, column												7	16	22	31	37	40	33
800 m.	200	,, line						1	.	3	2	.	1	2	1	2	4	2	4	8
		,, column		1	1	.	1	1	3	5	2	3	3	4	5	7	9	12	22	33
900 m.	200	,, line											1	.	1	.	2	2	2	6
		,, column											1	1	2	4	6	8	12	22
1000 m.	200	,, line													1	2	4	2	4	5
		,, column													5	7	6	7	21	28
1100 m.	200	,, line												1	2	.	2	1	.	3
		,, column											3	4	5	5	8	10	16	17
1200 m.	200	,, line												3	1	3	1	3	5	9
		,, column												5	6	5	4	12	20	19
1300 m.	200	,, line												1	2	3	3	2	4	6
		,, column											1	3	5	12	8	6	12	14
1400 m.	200	,, line													1	1	2	3	5	8
		,, column													2	7	9	10	20	19

N.B.—To turn metres into yards add one-tenth. Ex.—100
To turn yards into metres deduct one-tenth. Ex.—100

ble 14.

A."

SIGHT AGAINST MEN STANDING.

d on a rest. Targets 20 metres wide, 1·80 metres high.

					Nucleus or mean centre of impact.	Targets in rear of nucleus, distances in metres.																				
	40	30	20	10		10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210
					Number of hits excluding ricochets.																					
	60	64	70	68	71	61	61	57	36	29	21	16	9	8	4	5	5	6	6	5	4	3	3	2	2	1
	74	73	79	77	77	68	66	57	37	31	22	17	12	11	5	7	7	6	6	6	4	3	4	2	2	1
	36	41	51	56	64	58	50	44	37	27	17	13	14	13	14	14	13	8	7	4	3					
	51	60	69	71	68	59	52	47	39	33	23	16	15	16	17	17	13	8	7	4	3					
	35	49	48	49	52	51	47	34	31	24	24	16	11	5	3	.	1	2	2	2	1					
	56	63	62	56	62	64	52	42	37	29	25	16	11	5	4	2	2	2	2	2	1					
	19	26	26	29	35	28	33	32	26	29	17	13	6	3	4	5	4	4	3	2	2					
	33	36	39	42	45	40	39	41	32	30	18	15	10	7	6	6	6	5	3	2	2					
	15	19	24	24	31	27	29	23	19	14	8	5	3	1	2	1	1									
	25	29	37	40	42	41	39	30	21	17	9	6	4	2	2	1	1									
	10	12	14	24	31	28	23	22	19	13	7	5	6	5	3	1	2									
	26	34	38	42	42	38	29	25	23	14	11	7	7	6	4	2	2									
	18	14	9	15	27	26	13	5	7	9	10	3	1													
	26	20	27	38	42	31	17	11	18	15	11	4	1													
	13	9	7	17	18	17	14	12	15	11	5	2	.	2	1											
	17	14	19	24	29	29	23	25	20	15	6	3	2	2	1											
	6	12	13	15	22	14	10	6	7	2	.	1	2	2	1	1										
	19	24	31	34	35	22	15	12	9	3	2	3	3	3	2	1										
	6	10	8	8	14	7	10	8	6	3	2	.	1	1												
	18	18	32	19	22	17	19	12	11	5	2	2	3	1												
	2	3	8	10	11	10	9	17	9	4	.	1														
	5	11	21	26	22	24	25	25	13	4	1	1														

B."

IGHT AGAINST MEN LYING DOWN.

wide, 0·45 metre high.

	34	38	15	30	47	42	31	14	13	12	6	6	6	5	6	3	.	1	.	1					1		
	51	57	55	61	74	56	44	27	23	17	11	11	12	11	8	4	1										
	5	9	22	40	41	32	28	20	26	19	14	13	11	11	10	10	5	3	2	1	1	3	.	1	2	1
	20	36	51	63	63	52	53	45	39	32	24	24	22	21	20	16	9	6	4	3	4	4	3	4	3	1
	26	14	22	20	29	23	17	10	7	6	5	4	3	5	2	2	.	1	1	1						
	45	41	49	52	57	43	29	18	13	11	11	11	10	9	4	2	2	3	3	3						
	17	16	13	13	27	22	12	7	13	6	2	1	2	.	.	1	.	1								
	40	33	32	49	54	40	29	29	22	9	6	4	2	.	1	1	.	1								
	4	8	16	16	19	7	10	10	4	4	5	3	1	.	.	1	1	2	.	.	.	.	1	.	.	2
	22	33	36	38	34	28	25	16	9	11	8	7	7	3	1	6	4	3	1	.	.	.	3	1	2	4
	2	6	8	9	14	13	10	14	4	2	6	2	1	.	2											
	12	22	37	33	35	37	30	27	12	11	16	6	4	2	2											
	4	5	11	8	8	4	9	7	8	1	3	7	3	.	1	1										
	21	28	33	26	23	23	19	22	24	13	10	11	4	2	3	2										
	.	3	6	13	13	6	5	8	8	4	2	1	2	.	1											
	16	17	20	29	29	18	23	25	14	9	5	4	3		2											
	5	9	6	7	10	4	7	2	6	1	1															
	20	19	27	17	28	12	14	5	7	2	1															
	4	6	3	3	7	5	2	5	1	3	1															
	12	14	7	13	17	12	9	11	9	8	3	3	1													
	5	8	7	7	8	4	3	6	2	2	.	2	.	1												
	20	19	14	16	16	7	9	12	2	4	4	4	.	1	2											

enth. Ex.—100 m. $=100+\frac{100}{10}=110$ yds.

ne-tenth. Ex.—100 yds. $=100-\frac{100}{10}=90$ m.

Table 18.

Series with a combination of three sights.

Distances.	1100 m. sight.	1200 m. sight.	1300 m. sight.	Combined 1100, 1200, 1300 m. sights.	Combined 1100, 1200, 1300 m. sights.	Remarks.
Metres.	100 rounds.	100 rounds.	100 rounds.	300 rounds.	600 rounds.	
990	..	..	..	..	..	Each screen receiving 10 or more hits has its record printed in large figures.
1000	1	..	..	1	2	
1010	3	..	..	3	6	
1020	4	..	..	4	8	
1030	4	..	..	4	8	
1040	6	..	..	6	12	
1050	11	..	..	11	22	
1060	13	..	..	13	26	
1070	9	..	..	9	18	
1080	7	..	..	7	14	
1090	17	..	..	17	34	
1100	18	2	..	20	40	
1110	17	3	..	20	40	
1120	14	..	..	14	28	
1130	12	1	..	13	26	
1140	15	2	..	17	34	
1150	11	2	..	13	26	
1160	5	6	..	11	22	
1170	2	12	..	14	28	
1180	..	13	..	13	26	
1190	2	15	..	17	34	
1200	1	22	3	25	50	
1210	..	14	2	16	32	
1220	..	10	2	12	24	
1230	..	6	1	7	14	
1240	..	7	5	12	24	
1250	..	2	4	6	12	
1260	..	..	6	6	12	
1270	..	1	10	11	22	
1280	..	2	8	10	20	
1290	..	2	8	10	20	
1300	..	1	14	15	30	
1310	..	1	7	8	16	
1320	..	..	10	10	20	
1330	..	..	8	8	16	
1340	..	..	6	6	12	
1350	..	..	3	3	6	
1360	..	..	2	2	4	
1370	..	..	..	..	..	
1380	..	..	1	1	2	
1390	..	..	1	1	2	
1400	..	..	..	..	..	

Table 19.

Percentage of hits with one sight and with two; the distance unknown, and the series not displaced by atmospheric influence.

Real distances. Metres.	Percentage with the— 600 m. sight.	Percentage with the— Combined 600 and 700 m. sights.[1]	Remarks.
570	49	24·5	It is assumed that the distance has been judged to be 650 m.: the mean error in judging being $\frac{1}{7}$ of the real distance, this may vary between $\frac{650 \times 7}{6}$ and $\frac{650 \times 7}{8}$, that is between 760 and 570 m.
580	52	27·5	
590	51	27·5	
600	47	26·5	
610	34	20·5	
620	31	22·5	It must not be forgotten that the depth of the effective dangerous ground, resulting from the fire of 200 rounds with the combined sights of 600 and 700 m., is 280 m.; while it is only 180 m. with the single 600-m. sight and the same consumption of ammunition.
630	24	19·5	
640	24	21·5	
650	16	21	
660	11	18·5	
670	5	17	
680	3	19	
690	..	14	
700	2	17	
710	1	17	
720	2	14	
730	2	15·5	
740	1	9	
750	..	6·5	
760	..	3	
Total....	355	361·5	
Mean per cent.	17·75	18·07	

[1] The terms of the series have been taken from Table 17; the terms depending on the combination of two sights have been divided by two, to bring them into correspondence with an expenditure of 100 rounds with the single sight.

Table 20.

The vertical axes and the ordinates of the 1600 m. gerbe in collective firing.

Distances.	Extreme vertical dispersion due to differences in 10 samples of the Mauser rifle of recent manufacture.	Vertical axes of the shot groups in individual fire.	Total vertical dispersion due to the rifle.	Vertical dispersion resulting from errors in aiming of 30 minutes.	Vertical axes of the shot groups of the Mauser rifle in collective fire.	Ordinates of the mean trajectory of the 1600 m. sight.	Ordinates in collective fire of the	
							Upper trajectory of the 1600 m. gerbe.	Lower trajectory of the 1600 m. gerbe.
Metres.	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.
400	1·33	0·84	2·17	3·49	5·66	43·57	46·40	40·74
500	1·66	1·18	2·84	4·36	7·20	51·74	55·34	48·14
600	2·00	1·58	3·58	5·23	8·81	58·43	62·84	54·02
700	2·33	2·12	4·45	6·11	10·56	63·44	68·72	58·16
800	2·66	2·80	5·40	6·98	12·44	66·57	72·79	60·35
900	3·00	3·78	6·78	7·85	14·63	67·62	74·93	60·31
1000	3·33	4·74	8·07	8·73	16·80	66·39	74·79	57·99
1100	3·66	6·06	9·72	9·60	19·32	62·68	72·34	53·02
1200	4·00	7·60	11·60	10·47	22·07	56·29	67·32	45·26
1300	4·33	9·64	13·97	11·34	25·31	47·03	59·68	34·98
1400	4·66	12·12	16·78	12·22	29·00	34·69	49·19	20·19
1500	5·00	15·12	20·12	13·09	33·21	19·08	35·68	2·48
1600	5·33	18·72	24·05	13·96	38·01	..	19·00	−19·00

Table 21.

Comparison between the depth of the dangerous ground as obtained by calculation and from experimental firing.

Distances.	Vertical axis of the shot groups of the Mauser rifle in collective fire.	Tangents of angles of drop.	Depth of the ground struck by all the bullets in the gerbe.[1]	Theoretical dangerous zone in individual firing.	Depth of the dangerous ground as obtained	
					From calculation.	From experimental firing, *vide* Table 14.
Metres.	Metres.	Metres.	Metres.	Metres.	Metres.	Metres.
500	7·20	·02910	240	65	305	300
600	8·21	·03783	232	48	280	290
700	10·56	·04949	213	38	251	260
800	12·44	·06116	203	32	235	230
900	14·63	·07578	193	25	218	220
1000	16·80	·09042	185	20	205	200
1100	19·32	·10510	183	17	200	200
1200	22·07	·12278	179	15	194	210
1300	25·31	·14351	177	13	190	190
1400	29·00	·16435	176	13	188	180
				Totals	2266	2280
				Means	226·6	228

[1] Ground struck $= \frac{\text{Height of shot group}}{\text{Tangent of angle of drop}}$

Table 22.

Reduction in the normal interval of 10 m. between the screens, due to the ground on which the bullets fall not being parallel to the line of sight.

Sights.	Normal angle of drop.	Tangent of the normal angle of drop.	Tangent of the actual angle of drop when the ground on which the bullets fall, rises with reference to the prolongation of the line of sight.			Reduction in length of the normal 10-m. interval between the screens, when the ground on which the bullets fall, rises with reference to the prolongation of the line of sight		
			3°	5°	10°	3°	5°	10°
Metres.	° ′					Metres.	Metres.	Metres.
400	1 10	·02037	·07286	·10805	·19740	3·0	2·0	1·1
500	1 40	·02910	·08163	·11688	·20648	3·5	2·4	1·4
600	2 10	·03783	·09042	·12574	·21560	4·0	3 0	1·7
700	2 50	·04949	·10216	·13758	·22781	4·8	3·5	2·1
800	3 30	·06116	·11394	·14945	·24008	5·0	4·1	2·5
900	4 20	·07578	·12869	·16435	·25552	5·8	4·6	2·9
1000	5 10	·09042	·14351	·17633	·27107	6·3	5·1	3·6
1100	6 00	·10510	·15838	·19436	·28675	6·6	5·4	3·7
1200	7 00	·12278	·17635	·21256	·30573	6·9	5·7	4·0
1300	8 10	·14351	·19740	·23393	·32814	7·2	6·1	4·3
1400	9 20	·16435	·21864	·25552	·35085	7·5	6·4	4·6
1500	10 30	·18534	·24008	·27732	·37280	7·8	6·5	4·9
1600	11 50	·20952	·26483	·28360	·41040	8·0	7·3	5·2

Table 23.

Comparison between the extent of the effective dangerous ground when the bullets fall on a surface parallel to the line of sight, or on one inclined to it.

Sights.	Number of rounds.	Depth of the effective dangerous ground			
		When the bullets fall on a surface parallel to the line of sight.	When the bullets fall on a surface which makes with the line of sight an angle of—		
			+ 3°	+ 5°	+ 10°
Metres.	Metres.	Metres.	Metres.	Metres.	Metres.
400	100	210	63	42	23·1
500	100	200	75·5	50·4	29·4
600	100	170	68	51	28·9
700	100	130	62·4	43·5	27·3
800	100	110	55	45·1	27·5
900	200	140	81·2	64·4	40·6
1000	200	110	69·3	56·1	39·6
1100	200	120	79·2	64·8	44·4
1200	200	80	55·2	45·6	32
1300	300	100	72	61	43
1400	300	110	82·5	70·4	50
	Totals ..	1480	761·3	594·3	386·4
	Means ..	134	70	54	35

NOTES ON THE FRENCH ARMY.

In the French military periodical "L'Avenir Militaire" have lately appeared a series of editorial articles on the present condition of the field training of the French Army as shown at the autumn manœuvres. The articles are written in an apparently impartial spirit, and they give the results of an examination of testimony furnished from various sources, on matters concerning which the opinions of the observers appear to be, practically, unanimous. The verdict arrived at is as follows :—

On the whole the French Army has for several years made undoubted progress, but the progress has been slow. The upholders of the new tactics have had to struggle against routine. Far too many of the General Officers remain attached to the old system of warfare, and refuse to acknowledge the urgent character of the modifications rendered necessary by the modern improvements, not only in artillery, but also in infantry weapons. This tendency to remain *in statu quo* is most regrettable. It leads to hesitation in the subordinate ranks, and paralyzes the efforts of those who look forward and foresee the future.

Staff.—The work of the staff generally has been well done. The "ideas" for the operations have been judiciously selected, suited to the nature and form of the ground on which they were to be carried out, and to the time at disposal for their execution. The written orders were clear, and the respective situations of the opposing forces well described. But they were not always thoroughly understood, and the lower in the scale of command, the less precise they became. Some commanders, especially, extended their battalions to a degree quite out of keeping with the original "idea," and indicated besides only in a vague way the lines of direction, the points to be occupied, and the zone of action of each tactical unit. It is a known fact that in actual warfare the carrying out of orders most clearly laid down is exposed to many unforeseen hindrances, but when the commanding Officer of a battalion, for instance, receives himself, as a starting point, indefinite instructions, the state of indecision in which he is thrown necessarily communicates itself to the Captains acting under his directions. This was remarked in more than one instance. A tactical operation thus undertaken without a thoroughly defined object is nearly always a failure. If it succeeds, the result is due to chance, or to some serious fault committed by the opponent. It must be borne in mind also that the orders of the superior authorities arrived in the course of the evening in time to be communicated to the various commanding Officers and commanders of battalions before night. In previous years this was not always the case.

Infantry.—Infantry is the arm which suffers most fatigue in the manœuvres. It has had to carry out this year long and trying marches, especially in the East, in the regiments of the 7th and 8th Corps. The fatigue has been borne cheerfully. There have been but few sick. However, the knapsacks were far from being properly packed as on active service, a most regrettable proceeding, leading to illusions being created from which the awakening will later on be fatal. It is absolutely necessary that next year General Officers take this matter in hand, so as to insure the kit weighing during the manœuvres as much, or nearly as much as they do on service. It is the only way to judge whether the weight on service should be reduced, or the men trained by progressive exercises to carry this weight for at least fifteen

successive days at the manœuvres. The marches have, however, been well performed this year, and marked progress has been shown not only in marching power, but in the maintenance of order and discipline in the columns. As much cannot be said of the marches considered from the technical point of view, especially as regards measures of security. Infantry columns moved along the roads in close proximity to the enemy just as if he were several days' march away. There was no waiting for intelligence from cavalry scouts, patrols, or flankers, who, it may be observed, were far too reticent in the matter. It occasionally happened that a report from a flanking patrol to a commanding Officer to the effect that he could pass without fear a wood, a village, &c., reached him a quarter of an hour after he had gone by the point of danger. In warfare this inversion of the proper mode of proceeding must be avoided. To arrive at a point quickly is good, but to arrive there in safety is better; and to arrive quickly, exposure to falling by precipitate action into an ambuscade must be avoided. Outpost duties were well done when ordered, but outposts were not always placed before the cantonments, even when in presence of the enemy. There seemed to be some dislike to making troops bivouac for the purpose. The Officers and soldiers must, however, learn to undergo the fatigues of the duty. Wilful neglect of this kind during peace manœuvres may lead to false ideas being formed by men and commanders alike as to their duties of this nature in war. It is greatly in this direction that we sinned in 1870–71.

In the combat, the infantry showed itself possessed of high qualities as regards rapidity of movement. No obstacle seemed to be able to damp their *élan*. They showed less ability in taking advantage of ground and cover, but this was the fault rather of the leaders, and especially of the junior Officers. Whilst it would be imprudent to instil into the infantry, principles contrary to the French spirit of initiative and dash, it would be absurd altogether to neglect the use of cover. The artillery preparation for the attack has generally been insufficient, but even if it be true that it is useless at manœuvres to prolong the duration of this fire, it is equally desirable that on all, and especially on the Officers, should be impressed the actual facts of a combat, and the danger of a premature attack. The final assaults were carried out with great vigour, and this was done at the conclusion of long marches, and of advances over difficult ground.

As regards the conduct of the work by the Officers, the front occupied was out of all proportion to the number of men—in one case a corps holding a line by a force in the proportion of one man to two mètres—the infantry fire was badly regulated and directed, the object being apparently to retain sufficient cartridges to the end of the manœuvres; fire was also uselessly thrown away, and the defenders held out either an absurdly long time, or retired precipitately.

Cavalry.—The cavalry, except in the 7th and 8th Corps, utterly failed in reconnoitring duties. The French cavalry is not sufficiently exercised in connection with the other arms, especially with the infantry. They seem more at home with the artillery, but manœuvres of cavalry and artillery together teach the former nothing of their other duties. Still the cavalry has made great progress in the last five or six years. The marching was well regulated, and horses and men were on good terms with each other; the equipment is bad and heavy, and requires immediate reform.

Artillery and Engineers.—The former worked admirably, and showed themselves possessed of great mobility; the positions they took up were well chosen. The engineers did their work also satisfactorily. To sum up, the army is progressing, but it might progress faster.

The reserve men have in all respects done their work well, as have those Sub-lieutenants, Officers of the reserve who were originally non-commissioned officers, but of those Sub-lieutenants who were originally Officers, many

seemed to have lost their military habits, and not to have practice enough even to command a section. Unfortunately there has been occasion to remark that the relations between the senior and junior ranks seem to fail in that feeling of mutual respect which is so essential in an army.

The same paper gives, from a German source, the following criticisms dealing mainly with the cavalry. Decided progress has been made; notwithstanding the absence of all regular system in the general reorganization of the army and the irremediable precariousness of tenure of office by the Ministers of War, the instruction of the troops has improved, and more and more marked are the efforts of the Officers to increase their knowledge of their profession, and to study the weaknesses inherent in the nature of the men they command. Many years must pass, however, before the French cavalry can more approximately fulfil the requirements indicated by the late General v. Schmidt. Time is necessary to remedy the weak point, the remounts. But few regiments could muster the regulation number of 100 per squadron, the stables being full of young horses under five years old, of which there are 250 with each regiment. These regiments are not, therefore, ready for war, and there are such difficulties in the garrisons in the way of tactical instruction that the regiments are not sufficiently prepared to enable them to act in large masses of cavalry. A notable portion of the Officers of the higher grades are physically unfit to bear the fatigues of this kind of work; other Officers do not bear in mind the difference between the powers of the horses they ride themselves, and of those on which the men they lead are mounted; the guides and the men are not, therefore, well in hand. But there is evident improvement, both in the care bestowed on the horses and in the riding. Although this progress is limited to a few Officers, its value in increasing the general efficiency of this arm is very great. But the education of the cavalry Officer being the work of years, the concentration of six divisions of cavalry in time of peace is one of those exaggerations from which the French suffer. Years will be necessary for the formation of the groundwork of the employ ment of cavalry in large masses.

Every army has its own special qualities and its own special faults. Slackness of discipline and an inconquerable tendency to evade service regulations is the particular fault of the French Army. The fault exists no less under the Republic than it did under Napoleon III. For instance, it is no uncommon practice for cavalry Officers either not to keep the regulation number of chargers, or else not to bring them out at the manœuvres, not minding to appear there on the inferior horses. The practice is well known to, and is tolerated by the authorities. The action of the authorities in this respect seems to be in keeping with a recent order of the Minister of War on the wearing plain clothes, "because the conditions of daily life, particularly in large towns, continually oblige superior Officers to shut their eyes to disobedience of orders." The question of the necessity of the wearing uniform or plain clothes is one thing, but to give as the reason for withdrawing an order that the order is not obeyed is to subvert all principles of discipline. It must never be forgotten that the French Army is not only a military institution; it is also a political organ; and now that the Republic is mistress of the situation, and without much fear of competitors for power, the army is at a discount. At every crisis the ultimate decision rests with the army, and this influence is decisive on the spirit of all the military institutions of France.

Moreover, in an article which appeared in the November number of the "19th Century," by Captain Norman, entitled the "French Army of To-day," there is not only ample confirmation of the disturbing influence of politics on the army generally, but we find cogent reasons for believing that, as a military machine, the army of France is far below the standard of efficiency at which a Continental Power must maintain its armed forces if it aspires to any voice in the council of nations. Captain Norman remarks that just as the campaign of

1866 caused Europe to arm itself with the breech-loader, so did that of 1870 give rise to the demand for army reserves. "The ceaseless stream of well-trained men which enabled Germany to present veteran battalions at every point against the raw recruits France hurled against her, created a cry for universal service, for a territorial army, for enormous armaments; and so in 1872 the new French military organization first saw the light." Captain Norman is of opinion that the result attendant on army reform in France may be stated as follows:—"Skeleton battalions, untrained reserves, slack discipline, difficulty in obtaining good non-commissioned officers, and the zeal of the commissioned ranks deadened by slow promotion."

Without either questioning or accepting the accuracy of the figures given by Captain Norman, there is little doubt that the unsatisfactory condition of the French Army as set forth by him is substantially correct. Liability to military service in France is fixed at twenty years, the first five of which are with the colours; the next four are in the reserve of the active army; the next five are in the territorial army; and the last six in the territorial reserves. As the system has been at work only since 1872, the territorial reserve, which comprises all those men between the ages of 34 and 40, and three classes of the territorial army comprising all those between the ages of 31 and 34, have not yet received any contributions from the active army, and if they exist at all are formed of men who have not passed through the ranks. The army formed since 1872 comprises some 3,000,000 of men, but of these the larger moiety is absolutely untrained, and only about one quarter have served even three years in the ranks. The period of service with the colours was originally fixed at five years, avowedly on the ground that the national character of the Frenchman rendered him more difficult to train as a soldier than the less volatile and more submissive German on the other side of the Rhine. It has been found, however, impossible in practice to adhere to the five years' system in the infantry, and he is generally released at the end of three years. The army is also very weak in Officers, being some 14,000 short of the number required to place the active army and its reserve on a war footing. The territorial army is far below its strength both in Officers and men, 12,000 of the former, and 261,000 of the latter being required to bring it up to full strength, and little has apparently been done in the direction of forming the territorial reserves. Politics are more than ever a factor which enters into questions of promotion among the Officers, and the difficulty experienced in all armies in obtaining good non-commissioned officers is keenly felt. Very young soldiers soon attain the rank of non-commissioned officers, and become invested with powers of punishment equal to those possessed by Officers commanding companies in the British Service, and this before they have themselves learned to obey. Discipline throughout the army is at a low ebb.

The condition of the French Army just now, judging from the foregoing remarks, is such as to render it harmless to Germany, and considering the divided interests which are actively at work, not only in the army itself, but also in its administration, it is difficult to see whence can arise the influence which shall combine the discordant forces in forming an effective instrument for national defence. A hotel keeper at Le Mans, talking to some English Officers, and lamenting the state of the French Army, probably went very close to the truth when contrasting English and French Officers; he said: "All you gentlemen have one object in common, the good of your country; in our army we are each of us for the good of our own party."

L. A. H.

A PRUSSIAN CRITICISM ON THE AUSTRIAN CAVALRY MANŒUVRES OF 1883.

(From the "Vedette" of the 14th October, 1883. Translated by Captain HARE, R.E., D.A.Q.M.G.)

IT may be interesting to our readers to hear the remarks of the Specia Correspondent of the "Kölnische Zeitung" on our manœuvres at Brück on the Leitha; he says:

At the first of the two manœuvre exercises held on the 25th September, the Cavalry Division was ordered to advance against a skeleton or marked Division of similar strength placed between Pachfurt and Neudorf, and this movement was interesting inasmuch as a great many ditches had to be crossed, some being what might be called rather ugly. They were, it is true, hardly of such a character as to stop the general advance, but still it might have been reasonably expected that a good many riders would have come to grief, especially when, towards the end of the movement, the ditches would have had to be negotiated at a pretty stiff pace. I rode over the ground before the movement, and afterwards saw the Division clear the obstacles. Contrary to all my expectations, not a single horse came down, which speaks wonders for the good riding of the Austrian cavalry. Nor was there any checking or rushing to be seen, nor indeed any confusion whatever, and any one not being quite close would never have noticed the existence of so many obstacles. As regards the general arrangement of the attack, which took place as usual in successive lines (*Treffen*), the only facts worth noticing are the formation used was that much preferred in the Austrian Service, that is, the double column (very like the Prussian column on the two centre squadrons, or the *Kolonne aus der Mitte*), and the successive lines kept their time and distance perfectly One regiment did a thing which is rarely done at manœuvres, or, indeed, at any other time, that is, it caught a skeleton regiment of the marked Division, which was attempting to form up as a third line behind the first two, so quickly and suddenly that it had no time to show front. The attack, in fact, fell partly on the head and partly on the flank of the column on the move, and in real war would have practically destroyed it. The regiment that performed this feat managed to get close up to the enemy behind the spur of a hill, and then waiting for an opportunity, when he was in the most unfavourable position for defence, charged home with dash and determination.

There are few opportunities at manœuvres against a skeleton enemy for bold surprises, but this, as a fact, was one.

As regards the artillery advance, which was faultless, as it always is in the Austrian Service, fire was opened at the enormous range of 2,400 mètres, and the guns were generally kept at this range throughout the whole movement. Only quite at the end was a battery ordered to close with the enemy, but before its action could be properly appreciated, the exercise came to an end.

The second exercise which then followed necessitated a fresh formation and a totally different system of fighting. The Cavalry Division was supposed to be on the right flank of an army corps engaged with the enemy, and had received the order to attack the left flank of the enemy's infantry. This was the first time during this year's manœuvres that cavalry was employed against infantry, and when we think for a moment how often in real war

cavalry must reckon on having to deal with infantry, though perhaps not to attack it at all times and places, the idea of introducing the infantry element into the exercise must certainly be considered a happy one. If Cavalry Divisions are to be "independent," that is to say, are to be equal to undertaking wide sweeping movements, it must never be forgotten that they are sure to fall in with infantry. Of course, if they come across large masses of infantry they can do little or nothing, and their further advance is either stopped altogether or they must adopt some other plan of gaining the object in view. But if the opposing infantry is weak, cavalry must be prepared, with the help of artillery, to crush the resistance offered, either by charging home sword in hand or by dismounting and fighting on foot; and the latter system of fighting appears to be little practised in the Austrian cavalry. Perhaps they are wrong. The fact that cavalry Divisions must constantly in war come across infantry in small bodies would appear to point to the desirability of attaching a battalion of infantry (and what is the particular use of *Jägers?*) to each Division of cavalry, which might, by the direction of the Officer commanding the latter, be used now in one place and now in another, but always so that its whereabouts were unknown to the enemy. Infantry might often have thus been employed at Brück, as there happened to be a battalion in the camp there. But, as a fact, it was only employed once, and then to represent a skeleton enemy, the battalion being taken to represent two whole regiments. Any speculations as to what might be considered success or failure at manœuvres such as these with a skeleton enemy—unless, indeed, the case be quite a special one, as in the first exercise—cannot be otherwise than extremely vague. On the other hand, one point was very remarkable, and that was the cavalry appeared to come up so fresh, in spite of the previous calls that had been made on it, that it certainly had a very fair chance of success. The exercise, which must have taken a good deal out of horse and man, came to a close immediately after these attacks, and it certainly left a most favourable impression, both on account of the excellent riding of the men as well as on the hard condition of the horses.

To form anything like a real and general opinion of the fighting value of the Austrian cavalry, it must be considered under two distinct heads, viz., first, its strength or numbers and the material of which it is made, and, secondly, its training. Now, as regards numbers, the Austrian Army is even more than amply provided with cavalry. There are, it is true, only forty-one regiments of cavalry, but these consist of six squadrons each, all prepared to take the field in case of mobilization, whereas, it is well known, one of the five squadrons of a German cavalry regiment remains at home, to act as a depôt, and consequently must not be reckoned on for war. The Austrian cavalry would, in fact, with its forty-one regiments, put as many squadrons in the field as 61½ German regiments, of which there are altogether only 93. And as, moreover, provision is made for rapidly establishing reserve formations, the Austrian cavalry hardly leaves anything to be desired as regards numbers. The supply of horses in Austria proper and Hungary, and especially in the latter, more than amply covers all home requirements; indeed, there is plenty of room for exportation to other countries, France and Italy, it is well known, being considerable purchasers in the Austro-Hungarian market. This fact alone shows that the Austro-Hungarian animal must be a desirable cavalry horse. A German and Austrian cavalry regiment, if put alongside each other, would, as a matter of fact, be about equally well mounted. As regards arms and equipment, the usual rule is followed, that is to say, dragoons and hussars have swords and carbines, and lancers lances and revolvers. In the latter, forty-eight men per squadron carry a carbine instead of the lance, a far better plan than encumbering the man with both, as is done in some countries. The Russian plan is somewhat similar, but is the same for all cavalry, the only difference being that the front rank carry lances and the rear rank carbines.

The Austrian lances, it may be noticed, are without lance-flags, a fashion that, at any rate, it would be undesirable to copy, as it looks anything but pretty. I am glad to say I cannot draw pictures of the Austrian cuirassiers; these have been long ago abolished in Austria, whereas we are still hanging back in Germany at this step. The Austrian cavalry soldier's uniform is simple, and, with the exception of the dragoon's huge helmet, neat enough; the red forage-cap is especially so and gives the man a smart appearance. The red overalls, worn tucked in in knee-boots, are strange to the German eye, but wear better than might be at first supposed from such a bad colour, though unprovided with any kind of leather strapping. The officers' uniform is similar to the soldiers'; the various blouse-like jackets worn off duty are, however, too plain, and prevent the rank being easily recognized, a circumstance that many Austrian Officers are quite ready to admit.

Coming now to the question of training, let us first deal with the Officers. The Austrian cavalry has long and glorious traditions, a matter of immediate importance to the Officers of any arm. Austrian cavalry Officers have always had the reputation of being excellent riders, and, as far as I was personally able to judge, they fully keep this reputation up. Both seat and hands are faultless, and the horses are seen at a glance to be thoroughly broken. The greatest attention is paid in Austria to the training of cavalry Officers, and it is certainly of a very exacting nature. Every young Officer must, before he is appointed to a regiment, have passed eight months at a brigade school, where he is simply trained, first as a rider, and next as a coming riding-master. These young gentlemen have, besides the usual school instruction, to ride from six to eight horses a day, and are not only, as with us Germans, encouraged to ride across country, steeplechases, &c., but are ordered and actually taken out to do so without being asked. In this the greatest attention is paid to jumping, and it is hardly necessary to add, the excellent jumping of the men, which is so remarkable, cannot be otherwise than due to the still more excellent jumping of the Officers. As with the Officers so with the men, seat and hands are all that can be desired, and a bad rider is a very rare sight indeed. The men have, both when mounted and dismounted, a light, smart, and soldier-like appearance. School-riding seems to be very well understood, for the horses are well-balanced and willing, and are ridden up to the bit without persuasion. I have not, curiously enough, seen a single refusing horse, a fact that must be only taken to show that there are fewer of such brutes in Austria than in other countries.

At the exercises above alluded to were to be seen the movements of large masses, and consequently the usual deployment for the charge of the brigade and Division. Without going into the details of the Austrian cavalry field exercise, it may perhaps be noticed that the Austrian cavalry pay particular attention to simplicity of formation, and, as far as possible, use the double column (a formation formerly used in Germany, the *Kolonne aus der Mitte*), placing sometimes two regiments and sometimes the two divisions of a regiment (three squadrons each) alongside each other. The *Zugkolonne* (or column of quarter-squadrons, is also frequently used, but the *Halbkolonne*, or column of half-squadrons, so much used in Germany, never. Where the Austrian cavalry differs so much from the German is in the pace; both canter and trot (the former about 60 mètres to the minute) are much slower in the Austrian than in the German service, and of course this in actual warfare means being longer under fire. On the other hand, the slower pace has the advantage of greater order and regularity, and such a thing as a horse half breaking away and getting out of hand at the charge is very rarely to be seen. The Austrian plan of a slower trot than the German may be a sound one; at any rate, even among German cavalry Officers opinions are certainly divided on the question. The trot is a pace that has to be kept up for a long time, and is never used for the actual charge, and should consequently, even when kept up for half-an-

hour or more without a check, not take it out of the horses. With the regulation trot of the German cavalry, horses soon show signs of sweating and distress. The looser riding of the Austrian cavalry has perhaps something to say to the pace being slower.

And now for a word on the system of cavalry manœuvres carried out at Brück. The first thing that strikes one is the great use made of a marked or skeleton enemy, and together with it the system of two manœuvres on the same day. This is generally considered in Austria as necessary for the training of the commanding Officers.

There is no question but that the general arrangements of the manœuvres were such as enabled both troops and Generals to learn a great deal; the mere looker-on can say that the Austrian cavalry showed a very high state of training in carrying them out, and is fully up to the mark of the cavalry of a great Military Power. To judge troops of different States according to some fixed pattern or standard is a matter of impossibility and should never be attempted. Faults on one point or another can always be found, but these, when compared perhaps with other conspicuous merits, are found to vanish. This is certainly the case with the Austrian cavalry, and to form a general opinion otherwise than a very favourable one of its value, would be difficult indeed.

REORGANIZATION OF THE AUSTRIAN INFANTRY.

By Lieutenant Ross of Bladensburg, A.D.C., Coldstream Guards.

The system introduced by the recent reorganization of the Austrian Infantry received the Imperial sanction on the 30th November 1882; it was published in a General Order two days later, and was brought into force on the 1st January 1883.

Under this new regulation the Austrian Infantry is divided as heretofore into infantry of the line and into a rifle corps (*Jäger Truppe*). The total number of service battalions composing these two forces remains the same as formerly, but eight battalions belonging to the rifles have been absorbed into infantry of the line.

There used to be 80 infantry regiments, each composed of three field, two reserve, and one depôt battalion. The first five named battalions had four companies each, but the depôt had five, and under pressure it could be expanded into a sixth battalion of four companies, leaving in the recruiting district a small nucleus of one company to carry on the work at the depôt. It would be more proper to say that each infantry regiment was in reality composed of two regiments having a common depôt, viz., the field regiment of three, and the reserve regiment of two battalions. These two portions were practically independent of each other: they had different establishments; in peace time they were not liable to serve in the same district, and during a war they seldom formed part of the same infantry division.

Under the present system, introduced in 1883, there are 102 regiments constituted, each composed of four field and one Ersatz battalion. The new regiments have been made up by a partial dissolution of those which were in existence and by the incorporation of such rifle battalions as have been converted into infantry battalions.

Thus, where formerly the infantry of the line numbered 400 field and 80 depôt battalions, now there are 408 field and 102 Ersatz battalions. A still further increase is made by the provision of what is termed "Staff Infantry," which will be noticed further on.

The Austro-Hungarian Empire was divided into 84 recruiting districts: one for every infantry regiment, one (viz., Tyrol and Vorarlberg) for the Tyrolese rifle regiment, and three for the navy. The rest of the army was recruited from these districts in a manner laid down in the "Official Instructions for carrying out the Law of Military Service."[1] The same system still prevails, and every new infantry regiment has a district assigned to it, while the Tyrolese rifle regiment recruits from Tyrol and Vorarlberg as heretofore. A redistribution of recruiting districts has taken place, in consequence of the present change in infantry reorganization, and the remaining portions of the army will receive their quota of young soldiers from such infantry districts as are allotted to them.

The new infantry regiment is formed of the regimental staff—including the Officers and men belonging to the headquarters of the regiment and of the field battalions—and of 16 companies, numbered consecutively throughout the regiment, four to each battalion. The company may therefore be taken as the new basis upon which the strength of the regiment is constructed. In peace time the regimental staff is composed of 16 Officers and 68 men, of

[1] "Instruktion zur Ausführung des Wehrgesetzes."

which ten of the former and five of the latter are combatant, the remainder being reckoned non-combatant.[1]

The company on a peace footing is fixed at three establishments, viz., the normal, the increased, and the diminished strength. The first of these includes 86 men, all told (82 combatant)—3 Officers, 1 cadet, 13 non-commissioned officers, and 69 privates. The increased formation contains 131 men (127 combatant)—3 Officers, 1 cadet, 22 non-commissioned officers, and 105 privates. The diminished establishment contains 71 men (67 combatant)—3 Officers, 1 cadet, 12 non-commissioned officers, and 55 privates.[2]

The company's normal formation is that ordinarily adopted, and it is only under special circumstances that the companies of a field battalion can be raised to the increased establishment. When this is done for one battalion of a regiment the remaining three are by the regulations put upon the diminished formation ; to effect this, the men are transferred from one battalion to the other, and the necessary non-commissioned officers are called up from furlough.

The regiment has but five horses borne upon its strength in peace time, all of which belong to the regimental staff. It will be seen that during a war the Captains of companies are mounted, and it is perhaps worth remarking that such Officers who have to command from on horseback are not obliged to ride during their ordinary training. It is possible, however, that they are mounted during manœuvres, or when large bodies are massed together for drill.

Taking the companies upon their normal establishment, the regimental staff and the four field battalions are composed of 64 Officers and 1,396 non-commissioned officers and men, of which 58 of the former and 1,296 of the latter are reckoned as combatants and the remainder as non-combatants.[1]

The Ersatz battalion in peace time exists only *en cadre*, being 6 Officers and 23 men strong, of whom but two of the former and seven of the latter are combatant.[1] Two Officers, a surgeon, and three clerks are included in this small force as the *personnel* required to carry on the recruitment of the district.

As a general rule, infantry regiments are to be quartered in those districts whence they draw their recruits, and all four battalions should belong to the same infantry division ; but exceptions can be made under special circumstances, and individual battalions can be stationed away from their regimental headquarters. If the regiment is ordered away in peace time, one battalion at least must remain with the Ersatz cadre.

The duties allotted to the Ersatz cadre during peace are :—to carry out the yearly recruitment of the district ; to keep up the records of those men of the regiment who are not serving under the colours, but who are liable to be called up ; and to look after the stores required for a mobilization, as well as the train *matériel* which is attached to the regiment when in the field. In war time the Ersatz battalion is utilized to train recruits, and to send forward reinforcements to supply the place of such who have become *hors de combat*. Ersatz reserve men and men of the year's levy who are not required for military service under the colours, but who are allowed to go upon furlough, belong to the Ersatz battalion.

By the Austrian law, men found fit and eligible for military service are divided into three categories, viz. :—The yearly contingent of recruits who are enrolled for active service under the colours, 95,474 men ; the Ersatz reserve, or a yearly contingent of 9,547 men ; and the Landwehr, or the remainder of the year's levy. The first two categories spend the last two years of their military service in the Landwehr, and the force amounts, with the third category, to about 341,000 men. The active army, produced by the first

[1] Table II. [2] Table I.

category, is limited by law to 800,000, and the yearly contingent above mentioned is calculated accordingly. The Ersatz reserve also is fixed by law at a tenth of the active army; this force is liable to receive a training of eight weeks per year, but nothing was done to make it available for such home duties as it might be competent to perform. Now, however, the Ersatz troops are to be utilized by employment in the infantry depôts, and thus the men who have been trained to military service are reserved for duty in the field, and thereby the fighting strength of the army will be increased.

The regimental staff expands in war time into 19 Officers (10 combatant), 156 men (8 combatant), and 118 horses (of which 30 are chargers).[1]

The company is raised to a total strength of 236 men all told (228 combatant)—4 Officers, 1 cadet, 36 non-commissioned officers, and 195 privates, and 1 charger.[2]

The regiment for field service reckons therefore in war time 83 Officers (74 combatant), 3,868 non-commissioned officers and men (3,592 combatant) and 134 horses (46 chargers).[1]

The Ersatz cadre expands into a battalion of four companies, and into what is termed in the regulation a "staff section." The former consists of 21 Officers (18 combatant), 912 men (878 combatant), and 3 chargers—the Captains of Ersatz companies are not mounted as in the field companies. The latter is composed of 30 men, all of whom are combatant—10 non-commissioned officers and 20 privates.[1] The "staff section" of the various regiments are grouped into "staff companies," four to each company, according to the *ordre de bataille* issued by the War Ministry on mobilization. Three Officers, a sergeant-major, a pay clerk, and a bugler are added to and complete the establishment of the "staff company."

"Staff infantry" in Austria is the term given to such troops as are attached to the headquarters of army units, as orderlies, for the purpose of mounting guard, and in fact to perform all the infantry duties at the headquarters of General Officers in the field. Formerly the different regiments provided troops for this purpose, but by the new regulation the field battalions are to be weakened as little as possible. The same system prevails in the cavalry, since that arm of the Service was reorganized in May 1881; each regiment forming in war time a special troop of "staff cavalry" for orderly, escort duty, &c., without drawing upon the field squadrons for these purposes.

The Austrian system of army organization is essentially one which aims at keeping the combatant units as complete as possible in a campaign. Not only is provision made for a force at the headquarters of General Officers—as has just been said—and for the employment of men in the military police and in the field signalling sections, without trenching upon the normal war establishment of the troops as fixed by regulation, but the *personnel* composing regiments are divided into combatant and non-combatant portions. This latter arrangement is not the result of the new system of infantry reorganization, but was already adopted before, and it will be well to allude to it; for, although we in England make the distinction among Officers, we are not so careful to observe the difference among the men, and our fighting strength is often impaired by the omission. The Austrians classify both their Officers and men. Surgeons, paymasters, quartermasters (*Proviant Offiziere*), and Lieutenants who are charged with recruiting duties are all reckoned as non-combatant. The men are divided into three categories, viz., combatant armed with rifles, combatant without rifles, and non-combatant. In the first are all non-commissioned officers and men in the ranks; in the second, cadets, pioneers, drummers, and buglers; and in the third, clerks, bandsmen, artificers, non-commissioned officers and men belonging to the regimental train, bearers (*Blessirten Träger*), hospital orderlies (*Bandagen Träger*), and all Officers'

[1] Table III. [2] Table I.

servants. Exceptions to this rule are rare; two men per company, armed with rifles and belonging to the combatant strength, are told off as shoemakers, and remain with the train as a baggage-guard, and two corporals per battalion (with rifles) are detached from their companies to take charge of the pioneers. As a general rule also the non-combatant portion have no firearms, but an exception is made in favour of the five non-commissioned officers on the regimental staff who have charge of the bearers.

Of the 134 horses belonging to a regiment (excluding the Ersatz battalion), it has already been mentioned that 46 are chargers—30 for the regimental staff and 16 for the Captains of companies; the remaining 88 are draught or spare horses for the regimental train. Every regiment has 34 Government vehicles, viz., 10 baggage, 12 provision wagons, and 4 market carts, each with 2 horses, and 8 ammunition wagons with 4 horses each, together with 4 spare horses, of which 2 only are harnessed. Of these vehicles, 2 baggage, 3 provision, 2 ammunition wagons, and 1 market cart are allotted to every battalion; and when the battalion is detached from the regiment a small addition of horses is made. Besides the above, every battalion has attached to it an impressed country cart for the transport of meat. Drivers for the regimental train are obtained from reserve men in their fourth year who have served in cavalry regiments, and, if possible, they are attached to that infantry regiment to whose recruiting district they belong. Grooms for Field Officers are taken from the establishment of drivers, but there is no provision made for mounted Officers under that rank. The classification of the regimental train remains as it formerly was. The ammunition wagons always follow the troops, and march at the tail of the regiment; the market and meat carts come next, under a sergeant, and are called the "fighting train;" the baggage and provision wagons and cattle, called the "baggage train," follow after, and may be separated from the troops. The provision wagons, moreover, are employed to transport supplies from the "supply columns" belonging to the infantry divisions, to the regiments. The fighting and baggage trains are technically called the "small train," and are under the quartermaster (*Proviant Offizier*). The train non-commissioned officer belonging to the Ersatz battalion is usually appointed sergeant-major (*Wagenmeister*) on mobilization, and is the non-commissioned officer in charge of the regimental train. The men carry 70 rounds of ammunition, the ammunition wagons 53 rounds per rifle. The men have, moreover, two days' rations with them (excluding meat), and a reserve or *iron* ration; by the help of the regimental train there are with the troops four days' complete rations together with a reserve of sausages and biscuit. If a regiment is employed in operations in a mountainous district, the transport is effected by pack animals, either instead of or in addition to the ordinary carriage. These pack animals and their drivers are obtained from the "mountain train squadrons" belonging to the military train (*Train Truppe*).

There are 61 men allotted to each regiment to tend the wounded in war time. The bearers (*Blessirten Träger*), 12 men per battalion, are under charge of a sergeant-major per regiment and a corporal per battalion; they are provided with stretchers and with a second havresack for lint and bandages. The hospital orderlies (*Bandagen Träger*) are eight in number (two per battalion), and each has a knapsack filled with bandages or a field companion (*Verband- oder Medikamenter Tornister*). Should the force be operating in a mountainous country, the establishment of bearers for the wounded per battalion is doubled.

The pioneers of a regiment are attached for the purpose of making such easy works as may be required on the march, in camp, or during a battle. The non-commissioned officers (two corporals per battalion) are armed with rifles, but the men are equipped with spades, shovels, axes, saws, &c. Although the men belong to the various companies, yet in war time they are united into a "regimental pioneer section," under the command of a battalion Officer

taken from one of the companies of the regiment. Only half are at the disposal of the commanding Officer of the regiment; the remainder are, according to requirement, concentrated, and at the orders of the General of Brigade or Infantry Division, available to assist in the construction of such larger field works as may be required. These portions of the pioneer sections may be temporarily detached from their own corps.

It should be remembered that in Austria the lowest grand tactical unit is the division, complete in the three arms of the Service, and provided with a train carrying ammunition, supplies, and sanitary establishments; this force is made strong enough to act independently against the enemy, and to sustain by itself a struggle for a certain time. The brigade, on the other hand, is a variable force, and is liable to alteration in accordance with the requirements of the moment. Bearing in mind that the division contains twelve infantry battalions of the line, it now appears that the new regulation has been designed to form that unit of three regiments, just as the army corps is composed of three infantry divisions. Thus, in Austria, instead of having three battalions to the regiment, and the higher units, instead of being constructed upon the twofold system (*i.e.*, two regiments to a battalion, two battalions to a division, and two divisions to an army corps), we have four battalions to the regiment, and the higher units upon the threefold form (*i.e.*, three regiments to the division, with no constant quantity for the two brigades composing it, and three divisions to the army corps); by this means, in a normal formation, the regimental commanders can have a powerful reserve, and each of the Generals commanding divisions and army corps may have a reserve in hand equal to a third of the force they develop in the first line.

The Austrian rifles (*Jäger Truppe*) still consist of the Tyrolese rifle regiment and of several independent field rifle battalions. The former was composed of ten battalions and of ten depôt companies, which on an emergency could form two reserve battalions, and leave behind a small nucleus as a depôt. The latter were formed into forty field battalions and as many depôt companies, which upon pressure might expand into ten reserve battalions.

The Tyrolese rifle regiment now consists of a regimental staff, ten field and two Ersatz battalions (having in peace time a common Ersatz cadre); the field battalions have a battalion staff and four companies each, numbered consecutively from 1 to 40, and each Ersatz battalion five companies. There are only 32 independent field rifle battalions, each composed of a battalion staff and of four field companies, together with an Ersatz company, which in peace time exists *en cadre*.

Thus, where formerly there were 50 service rifle battalions and 50 depôt companies, there are now but 42 field battalions and 42 Ersatz companies. The eight field battalions by which this arm has been reduced have been converted into infantry battalions, and have been incorporated into the new infantry regiments. The Tyrolese rifle regiment, moreover, furnishes in war time two sections of "staff infantry," but this is not done by the independent rifle battalions.

All rifle battalions, whether belonging to the Tyrolese regiment or not, are formed on exactly the same model, and contain the same number of men both in peace and in war time. The rifle company is somewhat stronger than the normal formation of the infantry company, 95 men all told (91 combatants), and has but one establishment in peace time instead of three, viz., 3 Officers, 1 cadet, 16 non-commissioned officers, and 75 privates. On a war footing the field and Ersatz rifle companies are similar in every respect to the corresponding units of an infantry regiment, except that the former have four more corporals each, and have four buglers, instead of two drummers and two buglers.[1]

[1] Table I.

The Tyrolese regiment forms a special corps, and the field battalions composing it may be stationed outside their recruiting district; in such cases they are considered for all practical purposes as independent rifle battalions. The Ersatz cadre belonging to the regiment is placed at headquarters at Innspruck, and may be said to form part of the regimental staff for purposes of recruitment, for keeping up the records of such men as are liable to serve but who are not under the colours, as well as for the supervision of stores and train *matériel* required for mobilizing the field battalions quartered in the Tyrol and Vorarlberg. The regimental staff in peace time consists of 7 Officers (2 combatant), 17 non-commissioned officers and men (non-combatant),—including 5 clerks belonging to the recruiting office,—and 1 charger; the Ersatz cadre of 6 Officers (combatant), and 61 men (50 combatant).[1] In war time the regimental staff remains practically as it was on a peace footing; while the two Ersatz battalions amount each to 22 Officers (all combatant) and 1,145 men (1,115 combatant), and 3 chargers.[2]

It is intended that all rifle battalions, whether belonging to the Tyrol regiment or not, should be able to act independently in the field, two to each infantry division—the army unit consists of twelve battalions of the line and two rifle or detached line battalions. The battalion staff therefore contains such Officers and men as are required for independent action, and the quartermasters (*Proviant Offiziere*), surgeons, paymasters, artificers, bearers, train, &c., are all attached to it, which is not the case in an infantry regiment, where normally the various battalions composing it operate in the field together. For this purpose, rifle battalions of the Tyrolese regiment keep their own train *matériel* and their stores required for mobilization at the headquarters of the recruiting district in which they are stationed, and those belonging to the independent field rifle battalions are kept with their Ersatz company cadres —that is, in those districts whence they draw their recruits.

The peace strength of all rifle battalions is 17 Officers (14 combatant), 377 non-commissioned officers and men (353 combatant), and 2 chargers. That of the Ersatz company cadre is 1 Officer (combatant), and 2 non-commissioned officers (1 combatant) and 5 men (4 combatant).[1] In war time the battalion amounts to 22 Officers (18 combatant), 975 non-commissioned officers and men (913 combatant), and 37 horses (13 chargers, for the battalion staff and Captains of companies); the Ersatz company to 4 Officers (combatant), and 228 non-commissioned officers and men (223 combatant).[2]

What has already been said regarding the duties imposed upon the Ersatz troops, the classification of Officers, men, and train, the supply of men for military police and signallers without drawing them from the field units, the bearer detachments, and the arrangements for mountain warfare, applies equally to the rifles; also that relating to the pioneers, except that there is no Officer detached to command them. The train, however, belonging to all rifle battalions is increased by one wagon, and consists of three baggage instead of two, three provision and two ammunition wagons, and one market cart, together with an impressed country cart for the transport of meat.

Comparing the present with the past organization of the infantry, we find, in the first place, that there is no numerical increase whatever in that arm of the Service. The 80 infantry regiments, of five battalions each, amounted to about 398,000 men, all told (about 367,000 combatant); the new 102 regiments, of four battalions, excluding the staff sections, reckon some 403,000 men (377,000 combatant). The rifles formerly were about 50,000 men strong (46,000 combatant), now about 42,000 strong (39,000 combatant). Total infantry of the army of the first line was 448,000 men (413,000 combatant); it is now about the same. Of the depôt troops, there were formerly 93,000 men (89,000 combatant) belonging to the infantry regiments, and nearly

[1] Table IV. [2] Table V.

12,000 men (more than 11,000 combatant) of the rifles: total 105,000 men (100,000 combatant). Now there are 95,000 men (91,000 combatant) belonging to the Ersatz infantry regiments, and nearly 10,000 men (more than 9,000 combatant) of the Ersatz rifles. On the other hand, provision has been made for the supply of staff infantry at divisional headquarters and of military police and field signalling sections, without drawing upon the service battalions, and in future the regiments and rifle battalions will not be weakened for this purpose. The employment of Ersatz troops at the depôts also cannot but strengthen the active army, by enabling the infantry to be more easily kept up to the established war strength, notwithstanding the wear and tear of a campaign. With regard to this latter point, it is expressly ordered in the new regulation that when the field units are 10 per cent. below their war establishment, a demand for reinforcements is to be made by telegram direct to the depôt by the Officer commanding either the regiment or the detached battalion.

The actual combatant war strength of the various field companies and battalions does not appear to have been altered by the new system introduced. A slight difference has however been made in the non-combatant portion, due to the reduction of the regimental train, by the withdrawal of two wagons from the regimental headquarters, and one each from the rifle battalions, also by fixing a smaller number of reserve horses for the latter corps.

A great improvement has been effected by introducing uniformity in the regimental organization. The dual system of five battalions to a regiment—divided into a field regiment of three battalions and a reserve regiment of two battalions—was cumbrous and inconvenient, and must have led to difficulties when a sudden mobilization was to be carried out. When regiments were upon different formations there must, moreover, have been complications in the proper supply of the troops during a campaign; while, from a tactical point of view, the present system is superior to that which has just been abolished, and enables the adoption of a more regular front in the field than could have been the case before the present regulation came into operation.

It appears that one intention of the recent infantry reorganization has been to form 34 infantry divisions for active service. At three regiments per division, there is exactly enough infantry of the line for this purpose; but the rifles fall short, and could only supply troops for 21 divisions. Formerly the Austrians calculated their complete infantry force, first and second line, at 42 divisions; 32 divisions ready, one to be formed on mobilization, and nine Landwehr. According to the most recent account, there are 36 infantry divisions, of which four (viz., the 21st, 22nd, 23rd, and 26th) are to be constituted on mobilization; 15 army corps have, moreover, recently been established; and, at three divisions each, there ought to be 45 infantry divisions to complete the infantry armed strength of the Empire. Nine infantry divisions are formed out of the Landwehr, two from the Austrian States and seven from the Hungarian Kingdom, which, added to the 34 divisions of the first line, make up 43 divisions. The remaining two might possibly be formed out of the Landwehr of the Austrian States (of which there are as many as 80 battalions) and out of other troops at the disposal of the Government.

In conclusion, it may be said that, while the recent reorganization of the Austrian Infantry has not increased its numerical strength, yet it has brought that force into harmony with the general military policy of the Empire, and has rendered it more easy to keep the troops up to their war establishment when in the field, by the employment of a reserve which up to now has only existed on paper.

TABLE I.—*Peace and War Establishment of a Field Company.*

	Infantry Regiments of the Line.						Tyrolese Rifle Regt. and Field Rifle Battns.			
	Peace establishment.			War establishment.			Peace establmt.	War establishment.		
	Normal	Increased	Diminished	Field company.	Ersatz company.	Staff section.	Field company.	Field company.	Ersatz company.	Staff section.
	Strength of a Field Company.									
Officers:										
Captains	1	1	1	1	1	..	1	1	1	..
Lieutenants	2	2	2	3	3	..	2	3	3	..
Cadets	1	1	1	1	..	..	1	1	..	..
Sergeant-majors	1	1	1	1	1	..	1	1	1	..
Sergeants	2	3	2	4	4	1	2	4	4	1
Corporals	5	8	4	12	12	4	6	16	16	4
Lance-corporals	4	9	4	18	18	5	6	18	18	5
Pay clerks (N. C. officers)	1	1	1	1	1	..	1	1	1	..
Privates in the ranks	64	100	50	180	180	20	70	180	180	20
Drummers	1	1	1	2	2	..	..	..	..	..
Buglers	1	1	1	2	2	..	2	4	4	..
Pioneers	..	..	..	4	..	..	..	4	..	..
Bearers of the wounded	..	..	..	3	..	..	..	3	..	..
Officers' servants	3	3	3	4	4	..	3	4	4	..
Total personnel	86	131	71	236	228	30	95	240	232	30
Chargers for Captain of company	..	..	..	1	..	..	..	1	..	..

TABLE II.—*Normal Peace Establishment of an Infantry Regiment.*

	Companies.	Regimental Staff.																	Companies.[1]		Grand Total.			Combatants.	
		Officers.								Band.						Total.									
		Commanding regiment.	Commanding battalions.	Lieutenants.				Surgeons.	Paymasters.	Clerks.	Non-com. officers.	Men.	Batt. drummers and buglers.	Armourers.	Non-com. officers for train.	Officers' servants.	Chargers.	Officers.	Men.	Horses.	Officers.	Men.	Officers.	Men.	Horses.	Officers.	Men.
				Adjutants.	Quartermaster.	Recruiting Officer.																					
Regimental Staff and 4 Batts.	16	1	4	5	1	..		4	1	2	11	32	5	1	1	16	5	16	68	5	48	1,328	64	1,396	5	58	1,269
Ersatz Batt. Cadre	..	..	1	..	..	1		1	1	6	..	..	..	1	1	4	..	4	12	..	2	11	6	23	..	2	7
Total	16	1	5	5	1	1		5	2	8	11	32	5	2	2	20	5	20	80	5	50	1,339	70	1,419	5	60	1,276

[1] For detail, see Table I.

TABLE III.—*War Establishment of an Infantry Regiment.*

	Companies.	Regimental Staff.																										Companies.[1]			Grand Total.			Combatants.	
		Officers.								Band.		Train.								Horses.			Vehicles.		Total.										
		Commanding Regiment.	Commanding battalions.	Lieuts. Adjutants.	Lieuts. Quartermaster.	Lieuts. Recruiting Officer.	Surgeons.	Paymasters.	Clerks.	Non-commissioned officers.	Men.	Battalion drummers and buglers.	Armourers.	Non-commissioned officers	Drivers.	Butchers.	Purveyors and assistants.	Bearers, non-commissioned officers (armed).	Hospital orderlies.	Officers' servants.	Chargers.	Draught.	Spare.	Baggage and provision.	Ammunition wagons.	Officers.	Men.	Horses.	Officers.	Men.	Horses.	Officers.	Men.	Horses.	Officers.	Men.
Regimental Staff and 4 Battalions	16	1	4	5	1	...	7	1	2	11	30	8	4	8	48	5	8	5	8	19	30	84	4	26	8	19	156	118	64	3,712	16	83	3,868	134	74	3,592
Ersatz Battalion	4	...	1	1	...	1	1	1	6	...	...	2	1	1	1	...	...	...	...	5	3	...	...	...	...	5	16	3	16	896	...	21	912	3	18	878
Staff Section .....[a]	¼	.	.	.	.	.	.	.	.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	30	...	...	30	...	...	30
Total	20¼	1	5	6	1	1	8	2	8	11	30	10	5	9	49	5	8	5	8	24	33	84	4	26	8	24	172	121	80	4,638	16	104	4,810	137	92	4,500

[1] For detail, see Table I.

TABLE IV.—*Peace Establishment of the Tyrolese Rifle Regiment and of an Independent Field Rifle Battalion.*

	Companies.	Staff.																		Companies.[1]		Grand Total.			Combatants.	
		Officers.														Total.										
		Commanding regiment.	Commanding battalions.	Lieutenants.		Recruiting Officer.	Legal assessor.	Surgeons.	Paymasters.	Clerks.	Battalion buglers.	Armourers.	Non-commissnd. officers for train.	Officers' servants.	Chargers.	Officers.	Men.	Horses.	Officers.	Men.	Officers.	Men.	Horses.	Officers.	Men.
				Adjutants.	Quartermasters.																					
Regimental Staff ...	..	1	..	1	..	1	1	1	2	8	..	1	1	7	1	7	17	1	..	..	7	17	1	2	..
10 Battalions	40	..	1 0	10	10	..	..	10	10	10	10	10	10	50	20	50	90	20	120	3,680	170	3,770	20	140	3,530
Ersatz Batt. Cadre .	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	61	6	61	..	6	50
Total Tyrolese Regt.	40	1	10	11	10	1	1	11	12	18	10	11	11	57	21	57	107	21	126	3,741	183	3,848	21	148	3,580
Battalion Staff.....	..	..	1	1	1	..	..	1	1	1	1	1	1	5	2	5	9	2	..	..	5	9	2	2	1
4 Field Companies..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	368	12	368	..	12	352
Ersatz Cmpy. Cadre	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	7	1	7	..	1	5
Total Field Rifle Battalion.....	4	..	1	1	1	..	..	1	1	1	1	1	1	5	2	5	9	2	13	375	18	384	2	15	358

[1] For detail, see Table I.

TABLE V.—*War Establishment of the Tyrolese Rifle Regiment and of an Independent Field Rifle Battalion.*

	Companies.	Staff.																												Companies.[1]			Grand Total.			Combatants.	
		Officers.										Train.								Horses.			Vehicles.	Total.													
		Commanding regiment.	Commanding battalions.	Lieuts. Adjutants.	Quartermasters.	Recruiting Officer.	Legal assessor.	Surgeons.	Paymasters.	Clerks.	Battalion buglers.	Armourers.	Non-commissioned officers.	Drivers.	Butchers.	Purveyors and assistants	Bearers, non-com. officers (armed).	Hospital orderlies.	Officers' servants.	Chargers.	Draught.	Spare.	Baggage and provision.	Ammunition wagons.	Officers.	Men.	Horses.	Officers.	Men.	Horses.	Officers.	Men.	Horses.	Officers.	Men.	Horses.	Officers.	Men.
Regimental Staff	...	1	...	1	...	1	1	1	2	8	...	1	1	1	...	...	...	...	1	4	...	...	...	...	7	18	4	...	...	...	7	18	4	2	...
10 Battalions	40	...	10	10	10	...	...	20	10	10	10	10	20	130	20	20	10	20	60	90	220	20	70	20	60	310	330	160	9,440	40	220	9,750	370	180	9,130
2 Ersatz Battalions	10	...	2	2	...	...	...	4	...	...	...	...	4	2	...	...	...	...	4	6	...	...	...	...	4	10	6	40	2,280	...	44	2,290	6	44	2,230
2 Staff Sections	$\frac{1}{20}$	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	60	...	...	60	...	...	60
Total Tyrolese Regiment	$50\frac{1}{20}$	1	12	13	10	1	1	21	12	18	10	11	25	133	20	20	10	20	71	100	220	20	70	20	71	338	340	200	11,780	40	271	12,118	380	226	11,420
Battalion Staff	...	...	1	1	1	...	...	2	1	1	1	1	2	13	2	2	1	2	6	9	22	2	7	2	6	31	33	...	...	...	6	31	33	2	1
4 Field Companies	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	16	944	4	16	944	4	16	912
Ersatz Company	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	228	...	4	228	...	4	223
Total Field Rifle Battalion	5	...	1	1	1	...	...	2	1	1	1	1	2	13	2	2	1	2	6	9	22	2	7	2	6	31	33	20	1,172	4	26	1,203	37	22	1,136

[1] For detail see Table I.

CONVOYS IN SOUTHERN ALGERIA.

Étude sur l'Organisation et la Conduite des Convois des Colonnes opérant dans le Sud de l'Algérie, par C. Massoutier, Lieutenant au 1er Régiment de Zouaves, Chef du Bureau Arabe de Djelfa. Alger, Jourdan. 1882. Sold by Dulau, Soho Square, London. Pamph., pp. 69. Price 1*s.* 6*d.*

THIS pamphlet deals with convoys in a country where the transport is mainly carried on by camels, and the writer has collected the results of the experiences of French Officers on the subject. Major E. Gunter, Garrison Instructor, S.E. District, has kindly analyzed the pamphlet for the Occasional Notes, adding his own remarks on the subject. These remarks are included between brackets, and signed "E. G."—L. A. H.

[Although many of our Officers, who have served in India, and especially those who have taken part in the late campaigns in Afghanistan and beyond our frontier, are well acquainted with most of the points to which the writer draws attention, still some of these are so important that they can scarcely be too often insisted on. The Government of India have now had much experience in the organization of this kind of transport. The reports of the most able and experienced Transport Officers, and of commanding Officers during these campaigns, upon the different systems tried, must by this time have been collected and digested. It would be of advantage if some brief but clear "Instructions" founded on the above experiences were issued officially in handy form (say like the "Instructions for Regimental Transport") for the guidance of Officers in charge of convoys, &c.

The Sahara in Algeria differs in its northern and southern parts. The former consists of a series of moorlands, with few streams, generally sterile and uninhabited. The southern is made up of great plains and broad basins, whose bottoms are filled with marshy or sandy lakes, sprinkled with numerous oases. It has two distinct populations, the one settled, the other nomadic. The latter pass their lives in the arid plains adapted to rearing flocks and herds. At the beginning of summer, when the wells are getting dry, they travel northwards towards the mountain region, the "Tell," as it is called, their camels laden with dates and woollen stuffs, which they sell there, finding meanwhile grass and water for their animals. The caravan returns in the early autumn to the Sahara.—E. G.]

Lieutenant Massoutier prefaces his account by saying that mule carriage is unsuitable for convoys in Southern Algeria, owing to the difficulty of procuring water and grain *en route*, so, with the exception of a few mules for mountain guns, and for the ammunition and ambulance, camel carriage is employed. He thus enumerates the characteristics of the camel favourable to his utility: he exists a number of days without water, endures excessive heat, and moves with ease along heavy sand, subsists entirely on the desert plants found everywhere, carries a greater load than the mule, and his price is inconsiderable.

[Our experience scarcely bears out the idea that the camel can subsist entirely on desert roots, and certainly he cannot do hard work for long without a supplementary ration of some kind. Indeed the writer himself qualifies his statement by saying afterwards that if badly fed, he languishes and dies.—E. G.]

The camel is, on the other hand, a very delicate animal, suffers much from cold and inclemency of weather, is peculiar in his habits, taking his food only under certain conditions, and if overdriven and badly fed, he languishes and dies.

There is comparatively little difficulty in procuring them in Algeria. The commander of the districts, or of the troops, simply issues a *requisition* for transport camels when a convoy is to be sent off. This requisition indicates :—

(*a.*) The number of camels required.

(*b.*) The number of bach-hammars or overseers (in Afghanistan *camel sirdars*) for the convoy.

(*c.*) The number of sokkhars or camel drivers (in Afghanistan surwān).

(*d.*) The wages of these men.

(*e.*) The hire to be paid for the camels : (1) on the march ; (2) when stationary.

(*f.*) The date and place of assembly.

This order is delivered to an Arab official, who is charged with its execution. He summons the different tribal chiefs, explains the order to them, and apportions the number of camels to be furnished by each tribe.

Ordinarily one driver looks after four or at most five camels.

[In Afghanistan, one driver looked after from four to six camels.—E. G.]

Each driver must carry 30 days' food for himself, water-skins (chaguls) for his own drinking water, and ropes, with hobbles to fasten the camels' legs. Each camel carries a pack-saddle (kajāwah) and a pad or numdah with a double sacking (suleetah).

Camels in excess of the number actually required are always requisitioned, so as to be able to pick and choose.

The natives do not willingly furnish camels on requisition notwithstanding the advantages offered them. Much inconvenience has often been suffered by the French owing to the tribes suddenly migrating far into the south to avoid the requisition.

Recognizing their unwillingness, the French endeavour to make these requisitions bear as lightly and equably on the different tribes as possible, humouring the headmen, and issuing payments regularly without deductions, and giving liberal compensation in the case of loss of camels. In Algiers, the native prejudices are thus being gradually got over, especially of late years, when they have been very badly off, having suffered much from the great drought.

The camels are regularly "brigaded," as it is called, the animals, sirdars, drivers, &c., being regularly mustered, and a driver assigned to every four camels, which he retains charge of during the whole march. If owners, they have charge of their own camels, and, in any case, should always belong to the same *tribes* as the owners of their camels. The camels of one *tribe* are kept together, and always keep the same place in the line of march.

On mustering, a careful inspection takes place of all the animals and their appurtenances. Great care has to be taken to prevent the fraudulent substitution of weakly camels for those animals that have been selected and passed on mustering.

The convoy is then divided into sections of 100 camels, each under a *sirdar*, who has thus charge over 25 drivers. All orders are given through them, and they, with the drivers, are responsible for the loads, of which they keep lists. They must be active, energetic men, who can read and write.

The commander of the convoy keeps a diary, in which he enters daily all changes, accidents, &c. He has generally a soldier clerk to assist him in this.

The natives rarely make their camels carry more than 200 kilos. (about 400 lbs. or 5 maunds) of grain or other substance easily packed.

Their convoys choose the easiest routes, halt at the most convenient times and places to rest their animals, and if the pasturage is insufficient, give them regular rations of grain, &c.

In military convoys these advantages are unattainable. The route must of necessity often cross desert arid regions, and rocky or hilly ground, which is difficult for the camels. Their loads are inconvenient, and hurt them much, and they get no food but what they can graze *en route*. On these grounds loads for camels in military convoys should never exceed 150 to 160 kilos. (about 3 cwt. to 3¼ cwt.), and it is better even to keep them down to 120 to 130 kilos. (2⅔ to 2¾ cwt.). Only two loads should be placed on each camel, and they should always be slung in suleetahs. Those used are waterproof.

It is of great importance to balance the loads evenly. Cases and casks are very bad loads for camels, but, up to the present, other forms of packages have not been designed. Wooden casks are used for carrying the water. They contain from forty to fifty litres (about nine gallons) but are not all of the same capacity or shape. They must be soaked in water some time before starting, but even then five or six per cent. of loss has to be reckoned on. They should never be left empty, and, in hot weather, should be wetted outside frequently. Two coopers accompany each convoy for the repair of the casks. Plenty of spare bungs should be carried.[1]

Fatigue parties replenish the casks at the different watering places. Only buckets and cooking pots (*sic*) being available for this, the writer thinks it would be of great advantage if small portable pumps were carried for this purpose. On arriving at the wells the surface of the water being always more or less foul should be given only to the animals. After drawing for about an hour the water becomes purer. It is of great advantage to take a few natives who understand the art of drawing water quickly and well (bheesties). They are then sent on in front to prepare and clear the wells, &c.

Goat skins and skins of young camels have been tried for water vessels, but without much success.

The advantages of water-skins (puckals) generally are obvious. They hurt the animals less and hold more water than the casks. On the other hand they cause as much wastage of water, and deteriorate even more rapidly than casks, as they soon harden, and then split. They are more difficult to procure (!!), as expensive, and, on the whole, less enduring. They can be easily pricked, too, by evil-disposed persons without fear of detection. There is no doubt, however, that they are advantageous for long journeys. They should never be placed on the ground where they absorb sand, but on litters or beds of leaves or grass, or, better still, always hung up in the air.

[In India the bheesties use a kind of improvised tripod gyn for this.—E. G.]

They can only be managed by the native camel-drivers (?!) who understand the difficult art of tying them up, &c.

[Our old soldiers became after a few trials as handy as the most expert of bheesties.—E. G.]

These water-skins are tarred *inside* to prevent the decomposition of the water. This gives it a peculiar taste, to which, however, one becomes accustomed (the writer philosophically remarks), and it is very healthy.

When at a distance from the enemy, the convoy marches a certain distance from the protected flank. Spare camels move under charge of a non-commissioned officer with the rear guard, who see that the loads of those camels unable to proceed further are removed to others.

The camels generally move on a front of two sections (that is the leading camels of two sections abreast, with a small lateral space between them), groups of twenty to twenty-five keeping together in a string one behind each

[1] The allowance of water is 5 litres (8 to 9 pints) per man per day, 15 litres (3 to 4 gallons) per horse, &c., per day; one camel carried two 9-gallon casks. 5 per cent. should be allowed for leakage.

other, intervals being left between the groups, which should not be allowed to pass one another.

[There is no doubt that this method of moving two abreast is a great saving of space in column of route. It should be the rule wherever possible. In Afghanistan it was not sufficiently practised.—E. G.]

A certain amount of liberty as regards grazing *en route* is allowed to the camels. No soldiers, &c., of the commissariat or ordnance staff are allowed near the camels for fear they should overdrive them in order to arrive in camp early. No camp followers of any description are ever allowed near the baggage columns.

A special police guard accompanies the convoy. A section (about fifty) of infantry and half a troop of cavalry is considered sufficient for this purpose for a convoy of 1,000 to 1,500 camels.

Striking or ill-treatment of camels or their drivers is strictly forbidden.

Five or six horsemen go in front, a few on the flanks and some in rear to see the camels keep up. The infantry march in the rear, their knapsacks being carried for them.

The usual rate of marching is $2\frac{1}{2}$ miles an hour over good ground. This includes temporary stoppages here and there for browsing, but no halts are allowed.

The camels are never to be allowed to kneel *en route*, unless the convoy is attacked, as this position with their burdens only fatigues and injures them.

From the above it is evident that it is more difficult to keep order and regularity in a convoy of camels than in one of mules. The problem to be solved is how to assure the safety of the convoy, without unduly fatiguing the animals. This demands great activity, vigilance, and experience.

[Our experiences in Afghanistan seem to prove that though sometimes difficult to manage and fractious, mules are on the whole hardier, more plucky, easier fed, and, of course, far more mobile than camels.[1] They certainly require more water. Of this there was generally sufficient in Afghanistan.—E. G.]

The chief losses among camels occur from cold, changes of temperature, overdriving and overloading. Mere bad arrangement of the loads is a frequent cause of bad injuries. A certain percentage of loss must, however, always be expected, and need not be thought too much of.

They will generally go on with their burdens till they drop. The drivers sometimes kill them and flay them for their skins, and, if not looked after, they will sometimes kill them while there is still hope of their living, as the French authorities always give compensation.

The camel will not eat the camel-thorn when saturated with moisture, and it is then injurious to them. They should not, therefore, be sent out to graze while the dew is on the ground.

Camels cannot walk on slippery ground, and suffer much in moving over broken or rocky ground. Undulating ground is unsuitable, as they are from their make and shape obliged to trot when going down hill.

As a general principle camel-drivers should only be armed when of proved fidelity.

On the enemy's approach being signalled, part of the native horsemen (a portion being pushed forward as scouts to the front) surround the camels on all sides to prevent their straggling, and the convoy marches on without hurry or confusion. If an attack takes place, the camels are formed into a compact mass, and then made to kneel, and haltered. The drivers are

[1] Sir F. Roberts' celebrated march from Cabul to Kandahar is a case in point—the bulk of the transport animals being mules and ponies. A few camels were, however, purchased *en route*.—E. G.]

ordered to remain behind them, and forbidden to shout or cry out on pain of death. The infantry are formed in the centre of each of the sides of a sort of square which is formed round the camels, the cavalry towards the flanks.

The police remain behind them near the camels to keep order and prevent plunder.

On arrival in camp, the camels are formed in lines in the centre of the square in which the troops encamp, soft comfortable ground being chosen for them to rest on. They are unladen, the loads being arranged in lines, so as to facilitate reloading, and the camels are then sent out to graze. For this three or four hours are allowed. A camel guard of native horsemen is always sent, even when at a distance from the enemy, to prevent straggling, &c. Camels are easily frightened, and when they are, or when they scent from afar off some more pleasing pasturage, it is astonishing to see the speed with which they "make tracks," and thefts of camels will often take place notwithstanding every precaution. In this case native horsemen are requisite to trace them.

At night the sirdars are held responsible that no fires are allowed, and the police see to this and keep the military away from the camel lines.

[In Afghanistan this was never very strictly enforced. It was found generally that the intercourse between our soldiers and the native camel drivers promoted good feeling.—E. G.]

The camel lives from 16 to 18 years, being used from his third year as a beast of burden. Nearly all are geldings, a few of the finest stallions only being kept for stud purposes in the proportion of 1 to about 50 females. These stallions are for the most part quiet, and can be used for transport, but occasionally, in the rutting season, they become wild and unmanageable, and are then dangerous to men. The period of gestation lasts one year. During this the female is not employed for transport.

As regards the number of camels required for a convoy, that is of course a matter of calculation in each case. A column consisting of 2 battalions infantry, 2 squadrons cavalry, 1 section artillery (3 guns), altogether 40 Officers, 1,000 soldiers of all arms, 200 horses, 100 mules, 200 native horsemen carrying 5 days' water supply, and 30 days' rations carried by the men, is allowed by the regulations, transport in the following proportion, viz. :—

For baggage and material for each battalion	For staff	6 camels.
	„ 4 companies at 10 per company,	40 „
		46 „
Ditto for each squadron		10 „
For each Officer of superior rank		2 „
For the Officers of a company		2 „

Notwithstanding every effort the baggage camels suffer the most, as they are invariably overladen and injured by the nature of the packages they are made to carry.

The camp equipage requires 22 camels, hospital establishment 12, besides 12 mules; field battery 10.

In case there are not sufficient mules for the infantry or artillery first reserve ammunition it is carried on camels, which go at the head of the convoy under a special escort.[1]

[1] If water has to be carried for five days for the force, it would require, reckoning as above, 63,500 litres (about 13,600 gallons), necessitating for its carriage 756 extra camels.

[This will give some slight idea of the difficulties which had to be encountered by Hicks Pacha on his ill-fated march towards Obeid. An interesting account of the

[In Southern Afghanistan in lieu of the second line of wagons the following was the allotment of camels to the batteries of artillery :—

	9-pr. field battery. Camels.	9-pr. H. A. battery. Camels.	
Cartridges.....	3	3	Calculated at the rate of 5 maunds or 400 lbs. per camel. Shell in blankets or sacks, 18 in each packet, 36 for a camel. Fuzes, tubes, &c., in boxes.
Shell ammunition	18	18	
Fuzes, tubes, &c.....	1	1	
Blankets and stores....	12	14	
Spare.....	4	4	
	38	40	

The infantry battalion intrenching tools were at first carried on 11 camels, and subsequently 3 mules per company were allotted for this purpose, the tools being carried in iron crates especially constructed for this purpose :—18 shovels, 12 pick-axes, 2 felling axes, 1 crowbar.

2 mules were given to each company for their small-arm ammunition, and one or two for water.

The ammunition mules and intrenching tool mules followed behind the company, and even when marching rapidly easily kept up with the men. Two or three men were told off to look after them.

Each mule carried two ammunition boxes, each containing 600 rounds of Henry-Martini ammunition, and three leathern cartouches.

One camel carried four boxes of small-arm ammunition.

A European regiment 800 strong had 290 camels, 140 mules, 20 horses, 50 bearers for tentage transport, 10 days' provisions, hospital, &c. Some donkeys were also used, and carried about 180 lbs. of grain well. These animals were found of great service for this kind of transport. They were of a cheerful disposition and were well treated.

The *order of march* was generally as follows :—

3 squadrons native cavalry, 2 or 3 miles ahead.
2 companies infantry
1 working company infantry } from leading battalion.
2 guns field artillery.
2 wagons field artillery.
Small-arm ammunition and intrenching tool mules.
Interval, ½ to ¾ mile.
5 companies leading battalion with small-arm ammunition and intrenching tools.
4 guns field artillery.
1 wagon field artillery.
1 battalion.
4 guns heavy battery.
6 companies infantry.
2 miles.
½ troop cavalry at head and on flank.
Train in order of march.
2 companies infantry.
½ troop cavalry.

The European troops carried one day's cooked rations, and 10 days' provisions were carried in the regimental commissariat train.—E. G.]

The condition of the camel is seen by that of his hump, which in health should be full and firm. He is a delicate feeder, difficult to please. He requires 30 to 40 kilos. of forage a day, and at least three to four

Turkestan Detachment in Skobeleff's campaign against the Tekke Turkomans in 1880 was contributed to this Journal by Lieutenant Leverson, R.E. (vol. xxiv, p. 568).—E. G.]

hours' grazing a day. He can go from four to five days' journey with grazing alone, but it is better then to supplement it by grain, and it is necessary afterwards to give them one or two days' rest in a good pasturage.

[In Afghanistan, when grain was scarce, the ration was eight to ten seers of bhoosa or chaff (a seer being about two pounds), and this was always where possible supplemented by two seers of grain. When no bhoosa could be got, then three or four seers of grain were given.

Some camels which were specially purchased, and were of a particularly fine breed (coming from Zemindawar on the border of the Seistan desert), were given two seers of ata (wheat flour) daily, besides a large ration of bhoosa. These were specially looked after, and were always in good condition, even in long continuous marches, when they carried between five and six hundredweight. A ball of camphor and pepper given weekly or so improved their condition.—E. G.]

The camel endures thirst better than hunger. He can go twenty (! ?) days without water *if not worked*. In the cold weather, when employed in transport service, he can go from nine to ten days without water if they are not exceptionally hot. During the last few days of this abstinence it has been remarked that he scarcely grazed at all.

In summer or hot weather when working he should have water every two or three days, and as a rule he should be watered whenever there is a favourable opportunity, for after long abstinence camels will rush to the water and soon foul it. They seem to prefer clean water, slightly salt. After a long abstinence they should always be watered two days running.

[The writer's remarks on the necessity of more frequently watering camels are well worth attention. Though they can exist a long time without water, there is no doubt that they work better if it be regularly given them.—E. G.]

Lieutenant Massoutier enumerates the diseases of the camel, viz., camel sores, mange, &c., but the most formidable enemy he has in Algeria seems to be the Debab fly, of which the bite is so poisonous as to cause great suffering and frequently death within twenty-four hours.

[Camel sores were treated in Afghanistan with a mixture of kerosine oil and a dash of carbolic acid in a rough and ready way, but it seemed to answer.—E. G.]

The pay of the drivers is issued on every fifth day to the sirdars on a form of pay list showing the name of the sirdar, and the number of drivers, animals, &c., he is responsible for, in separate columns, the rate of hire per day when halted and when marching.

The usual rate is 3 francs a day for sirdars and 1 franc a day for camel drivers, whether halted or moving. The Officer pays the sirdars in presence of two witnesses, and immediately the sirdars distribute it. Each sirdar carries a small book in which every payment made, march done, &c., is entered.

When the drivers have consumed their own rations they are allowed to purchase Government grain, payment for which is made by deductions from their pay.

The usual sum paid for camel hire is a rate of 3 francs per diem when on the march, and $1\frac{1}{2}$ francs per diem when in station.

[As regards the French hiring system, it seems preferable, because the owners always take a certain amount of care that the animals are looked after. Feeding is still a difficulty. Government rations must be given or the camels get out of condition, and the work is not done.

It is impossible, of course, to carry grain enough for all the camels of a force, and it must be supplied by the country through which the march takes place if possible. Where, as in Southern Afghanistan, when Sir Donald Stewart marched up to Ghuzni and Cabul, the country is deserted and the crops all carried away, this is a poor source of supply, and the camels suffer.

In regard to the difficulty of hiring camels, it is seen that even the French have to "*menager*" their people. When, as in Afghanistan, a great part of the population is inveterately hostile, it becomes a matter of great difficulty.

In Southern Afghanistan camels were usually purchased. Price is a matter of supply and demand. The Government price there was 100 rupees. Though it was often difficult to procure *good* animals for this, a fair number could generally be obtained for 120 to 125 rupees.

As regards the general difficulties of procuring hired transport, it does not seem too much to demand from the inhabitants of every country of which we administer the Government, as India, that every owner of carts, horses, ponies, mules, bullocks, camels, should be compelled to *register* annually every conveyance he has and animal for transport in the books of the District Officers (collectors of revenue, &c.), placing his value on each. The Government could then lay their hands, when they found it necessary, prior to organizing an expedition, upon a certain though, perhaps, limited number at a stipulated price.

Since the termination of the Afghan campaign the whole question of transport for Asiatic warfare has been thoroughly gone into in India. The subject has been fully treated in principle and in detail in a series of able essays by experienced Officers in India, the most notable of which are those by Lieutenant C. G. Barrow, D.Q.M.G., and Major King Harman, A.Q.M.G., which have been published with others in No. 46, vol. ix, of the Journal of the United Service Institution of India, which contains much information of value concerning military matters.

Since then the Government of India have set on foot a regular transport scheme as a tentative measure. It provides for half transport for a certain number of regiments on or near the frontiers, and for the creation of transport depôts at the principal strategical points. The basis of the system being that of regimental transport provides for the expansion of the units in time of war. About one driver to every three camels, and about one driver to every two mules, is to be always maintained.

The matter of drivers is certainly of the first importance in the matter of camel transport, so much depending upon the way in which the animals are treated. The necessity of having a large nucleus of *thoroughly trained* drivers in time of peace is all-important.

The question of arming the drivers is still debated.

In Sir Charles Napier's famous camel corps, *one* driver was appointed to each camel, and armed, drilled, and taught to fight.

These were divided into divisions of 600 each. The system answered well, no grazing guards, escorts, fatigue parties, &c., being required.

On the other hand, the Bombay bullock cart drivers employed in the Bolan Pass were armed, and once or twice the Murrees came down to cut their throats with their own swords that they did not know how to wield.

There is no doubt that the drivers should be well organized and under strict discipline. This is quite compatible with treating them well and liberally.—E. G.]

REVIEWS.

Die Anlage, Leitung, und Durchführung von Feldmanövern. Von A. v. Boguslawski, Oberstlieutenant. Mit 15 Skizzen und 1 Figurentafel.

The Arrangement, Direction, and Execution of Field Manœuvres. By Lieutenant-Colonel A. v. Boguslawski. With 15 sketches and 1 plan. Berlin (Ernst Siegfried Mittler und Sohn), 1883. Size $8\frac{3}{4}'' \times 6''$. Weight $9\frac{1}{2}$ ozs. Price 5*s.* 6*d.*

Lieutenant-Colonel von Boguslawski has been so long known, both in his own country and in the rest of Europe, as a profound thinker, and as an able writer upon military subjects, and more especially upon tactics, that whenever any work of his is announced as forthcoming, its publication is looked forward to with eagerness by the little world of military students in all countries.

The present work, though from its nature of less engrossing interest than many by the same author which preceded it, is nevertheless of considerable value, both on account of the information contained in it, and also because of the many useful suggestions made by the writer for the improvement of "field manœuvres," a branch of military training now recognized in most European countries as essential for the purpose of completing, as far as this process can be carried out in peace, the professional education of the soldier, and of the Officer.

We purpose giving a brief analysis of the work before us, with special notice of whatever appears applicable to our own army.

The author states at the commencement of his preface, that numerous as are the works on every branch of drill and tactics, no really comprehensive treatise has hitherto been published on the combined exercises of all arms, known in Germany by the name of "manœuvres." The absence of such a work in that country may, he thinks, be accounted for by the existence of the excellent official "Regulations for the Training of Troops in Field Duties, and for Exercises of the more advanced Description," which regulations, however, were issued just before the war of 1870–71, and came into force without any modification immediately after the war, before its lessons were sufficiently understood, since which time, moreover, many important alterations have taken place everywhere in tactics and in armament. The writer thinks, therefore, that it is high time to review the effect of these regulations upon professional opinion, and the manner in which they have been carried out in practice, also to discuss the experience gained in Germany and elsewhere since their issue. He proceeds to describe the plan of his work, which commences with an historical sketch of the development of war training, especially in the shape of field manœuvres as practised in Germany, a branch of training which he considers and aims at proving to have exercised a very great influence upon the result of more than one campaign, from which he deduces the necessity of keeping in advance of other nations in this respect, a position, as he says, "undoubtedly held by the German Army up to the last decade." "The field manœuvres of the present day should include every feature, tactical or strategical, which can be embodied in peace practice; they should serve both to train the men and to instruct Officers in the art of leading them in battle. So various are the aspects of the subject, that it must be treated in a very comprehensive manner, and if it be allowed that the *field manœuvre* should be as near an approach to actual warfare as possible, we should seek to make it a true picture thereof, and not a caricature." After the historical sketch comes the main body of the work, consisting of three parts entitled—1. The Arrangement; 2. The Direction; 3. The Execution. Each of these parts contains several chapters in which the author gives his general views, and also discusses at considerable length the construction and manipulation of the various parts of the

machinery which places the manœuvring troops in the field, and keeps them in action. Thus we see by the table of contents that the following matters are dealt with:—Preparatory arrangements—The plan of the manœuvres prepared—Subsistence—Formation of detachments—How military considerations affect the plan of operations—The employment of troops kept in hand at the disposal of the Director of the manœuvre (*Verfügungstruppen*)—How peace conditions affect the plan of operations—Examination of the directions given by the leaders of the two parties—The situation judged—Possible alterations—Personal demeanour of the Director during the manœuvre towards leaders, troops, and any higher authorities who may chance to be present—Commencement of the manœuvre—Collision—The Director intervenes by the use of supposititious troops; of assumptions; of a marked enemy; of troops held in reserve; by his final decision.

Umpires and their Action.—Crisis of the manœuvre—The situation judged—General decision of the Director—His conduct when one party retreats, and when the manœuvre is brought to a close—Interference in case of action inconsistent with the conditions of warfare—The necessity of pushing an attack home—Considerations affecting the welfare of the men—The critique—The situation determined—Communication of orders—Receipt of the general idea—Issue of orders—Recommencement and termination of a manœuvre—Throwing out a chain of outposts—The presence of umpires necessary whilst this is being done—Communication of orders before the manœuvre—Directions and communication of orders during the manœuvre—Personal demeanour of the leaders—Assembly of the troops—How they are screened from the observation of the enemy—The attack in its various forms—The defence—An example of unusual conduct—A feigned retreat—An ambush—Use of the different arms—cavalry, artillery, infantry—Close of the manœuvre—Examination of a position—Positions on which to rally—The signal "Halt"—Course pursued when the command is handed over to another Officer—Reports.

This completes the "main body" of the work, the concluding part containing some of the author's suggestions for the amendment of the system of field manœuvres as now carried out in Germany, other suggestions of the same nature being scattered throughout the book. What is a "field manœuvre" properly so called? Not a mere repetition on ground more or less varied of drill movements already practised in the barrack square; what we call a field day—not the same, with the addition of an enemy indicated by flags or by skeleton battalions of men—not a "sham fight," when there is indeed both an attacking and a defending party, but when the whole course of the action is arranged beforehand, when it is well known which side is to be victorious, and when every probability must be sacrificed to the supposed necessity of a general march past at the end of the day's proceedings. These forms of field exercise are all useful in their way (except perhaps the last) as preparatory to the "field manœuvre" proper, which, to use the author's words, is the "representation of an act of war in which the leaders of the two parties opposed to one another, as well as their followers, enjoy perfect freedom of action, each being expected to perform in the manner which seems to him best the task assigned to him on the ground of certain definite assumptions. We may be quite sure that neither party will do perfectly right, and, moreover, that there will generally be a great difference of opinion at the time as to what course is perfectly right; but we may also rest assured that as the field manœuvre proceeds the propriety of one course of action and the impropriety of the other in any given case will become evident enough if the manœuvre is properly directed."

From the earliest times, and in every country where bodies of armed men have acted together, it has been necessary for them to undergo some system of drill and training, but it was only at the end of the 17th century that the first symptoms of the field manœuvre are recorded. This took place in France, where during the intervals of peace Louis XIV's troops formed occasionally camps which became places of fashionable resort, and where amidst all the splendour and dissipation of the Court "sham fights" took place representing the attack and defence of entrenchments and such like. The same fashion was soon after imported into Germany, but no progress was made until after the Great Frederick's first Silesian war, when these exercises called "war evolutions" became much more practical.

Still they were merely large field days, the enemy not being even *marked* till after 1750, and although they were very useful in training the troops to the extreme precision of movement which was considered of paramount importance in those days, and which enabled Frederick to perform some of the wonderful tactical feats for which he is celebrated, they never deserved the name of field manœuvres. Towards the end of the great king's life, the "war evolutions" lost somewhat of their martial character, and after his death degenerated into mere routine—the spirit had departed, the letter alone remained. Meanwhile other nations had been progressing on the same path; in Russia, Austria, and France, camps of exercise became habitual; and we find it recorded in "Dumouriez' Memoirs" that in the last-named country, during the latter half of the 18th century, manœuvres took place with one corps operating against another, apparently the first of this description.

During the time of the French Republic and Empire there was but little opportunity in any country for *peace* manœuvres, but the Prussians were most assiduous in drill and in the performance of the minor tactical exercises from the time of their great disaster up to that of the war of liberation, the effects of the careful training being made manifest by their superiority in manœuvring power. In the meantime the true principles of the higher military training were making their way in the army, the consequence of which was the issue of the order of May 12, 1822, for regulating the great autumn manœuvres, which were divided into the field exercises of large bodies and manœuvres in two bodies, to which latter part seven days were allotted.

Thus the system of *field manœuvres* as now carried out in Germany really originated in 1822. Nearly half a century was fated to elapse before the armies of Prussia were again to take the field in actual warfare. It was no doubt in no small measure owing to the regular practice of *field manœuvres* that when the time came both Officers and soldiers of that nation showed an efficiency totally unexpected by foreign critics. But this system did not at once come to maturity. Its excellence was of slow growth. In the early years financial considerations much interfered with its development, and in 1828 the time allowed for manœuvring was much shortened; and for some time after the influence of a long peace betrayed itself by excessive attention to detail and by the sacrifice of practical considerations to those of mere display. In fact, the Army of Prussia was in danger of becoming, what those of other countries did more or less become with less excuse during the same period, a superior kind of showy police; but it was saved from this risk by the orders of July, 1840, which gave a fresh impetus to the higher military training, and made the *field manœuvre* a greater reality than it ever had been. From that time forward it has been a permanent and honoured institution in the Prussian Army, and continues to be so in that of Germany. For another generation, however, Prussian soldiers continued to be spectators whilst their neighbours now and again waged war. The orders for field exercise issued in 1861 showed that they were not idle spectators, but that they were profiting by watching the doings of others. There came at last the time for them to apply the lessons learnt in peace to the realities of war. The first application on a large scale was wonderfully successful. Still thoughtful men detected many tactical defects, and great changes were determined upon, which were introduced into the Service by the orders prepared, as we have noticed, before the war of 1870–71, issued immediately after it, and substantially in force at the present moment, though in Colonel von Boguslawski's opinion requiring revision.

Whilst Prussia had thus, with little interruption, been making constant progress for nearly half a century, the other European Powers had not been altogether idle, though until the war of 1870 their system of training was far behind that of the nation, which they all more or less endeavoured to imitate after that war. The great defect everywhere was, that the field exercises, on however large a scale, did not rise above the level of "field days" and "sham fights." The great principle of leaving the issue of the contest between the two manœuvring forces to be determined, as far as it can be in peace, by the ability of the Commanders and by the manœuvring power of the troops—the principle, in short, which is the distinguishing feature of the true field manœuvre—was everywhere absent, and in consequence there was a want of reality in the whole performance which was very

damaging to professional instruction. After 1871 all nations recast their systems of training more or less according to the German type.

The French introduced the system thoroughly, as far as regulations go, and in some respects, indeed, outdid their neighbours; for instance, as to the number of corps operating, and as to the proportion of reserve men called out; but it seems that as yet the great principle above referred to has not been completely accepted, and that the unwonted liberty of action when granted to Officers, as it is sometimes, is somewhat unpopular with them, because they are at a loss how to make use of it. The case is doubtless the same everywhere under similar circumstances; but you must do away with the leading-strings in peace-time, in tactical as well as in other matters, if you want leaders who can judge and act for themselves in war. The French Army is now guided by the "Instructions for regulating Autumn Manœuvres," issued in 1879, and going very much, perhaps too much, into detail. In Russia, in Austria, and in Italy progress has latterly been made, though much still remains to to be done. In all these countries the great principle which regulates the true field manœuvre is accepted as correct, but in none of them is it acted upon so thoroughly as in Germany, and until this is the case the armies of all those nations must remain inferior to that of Germany as far as regards the training of Officers, and especially of those in the higher grades.

Colonel v. Boguslawski has very little to say about England; and indeed, in the matter of field manœuvres, as the Colonel understands them, there is but little to be said about this country, where that branch of military training is still in its infancy, either because not appreciated as it should be, or because, like Prussia for some time after the war of liberation, Great Britain is too poor to spend sufficient money upon such matters. In the poorest country, however, if it is thought necessary to maintain a standing army at all, those in supreme authority would do well to ponder over the deductions drawn by the writer of the work before us from the history of the progress of warlike exercises, that the "same may either contribute largely towards victory or may prove merely a costly farce, according to the mode in which they are conducted, namely, whether they are in harmony with or in opposition to the realities of war."[1]

The space at our disposal will only allow of a very brief notice of the many important points touched upon by the author. In pages 33–36 will be found a good description of a district suitable for field manœuvres, which is the first thing requisite for carrying them on, and which is by no means easy to find in some highly-cultivated and thickly-populated countries. There is, however, a sufficient abundance of such districts in Great Britain and Ireland. The German military authorities disapprove of encamping troops when engaged in field manœuvres, principally on account of the unreality of the proceedings; consequently troops are placed either in bivouacs or in cantonments. As it was found that frequent misunderstandings arose between the civil and military authorities with reference to the quartering of troops upon the inhabitants, mixed commissions were appointed in 1880 to regulate such matters. Details are given in pp. 36–38.

It is the custom in Germany to form depôts of provisions in the district selected for a field manœuvre, and to obtain supplies by contract, hired transport being employed to convey the provisions from the depôts to the troops. This is all very well when there is only an imaginary or marked enemy, in which case the night-quarters of the different corps are assigned beforehand, but in the case of a real "field manœuvre," the result of which is doubtful, delay is likely to arise in bringing up the rations in the evening, and although such accidents will frequently occur on actual service, and must then be borne cheerfully, the utmost care should be taken to prevent this occurrence at peace manœuvres. This can only be done by attaching well-horsed provision wagons, containing two or three days' supplies, to

[1] Whilst writing thus of England we do not forget the practice of "minor tactics" by small forces of all arms introduced amongst us some years ago, and still regularly carried on. The "minor tactical" field day is really an infant "field manœuvre," and may be made most useful in teaching Field Officers to handle mixed bodies of all arms.

the manœuvring troops. These should be supplied by the military train, and the regimental transport should also take part in the manœuvres, a practice not at present followed in Germany, though habitual in France. (See pp. 39–40 and 200–202.)

The plan of the manœuvre must be greatly influenced by the time allowed for it and by tge number of troops engaged. Our author thinks that a greater expenditure of time and a larger concentration of troops is advisable than is the case in Germany. At present strategical combinations in which the employment of independent cavalry divisions would be most instructive must of necessity be almost excluded from the plan of operations; and the director of the manœuvres (umpire-in-chief) is so pressed for time that he is bound to do his utmost to ensure an early collision between the contending parties. It is desirable, too, that the strength of tactical units should be brought more nearly to the war establishment than is done in Germany. In this respect the French set a better example (see pp. 43, 44, and 194–197). Casual encounters (*Begegnungsgefechte*) (see p. 50) are too often produced at peace manœuvres, and very unnatural situations are the result thereof. In actual warfare they are quite exceptional (Solferino for instance). A very early hour should occasionally be chosen for commencing the day's work: night marches should be practised and attacks by surprise at early dawn. "Night attacks also on a large and small scale should be executed. It seems indeed desirable to establish as far as possible by actual experiment at our manœuvres, on some early occasion, how far the opinion which some hold is justified, that great results are to be expected in future from such attacks. In the war history of Prussia we find records of night attacks on a large scale, one of which (Hochkirch) was a success for our enemy, whilst the other two (Laon, 1814, and Le Mans, 1871) were victories for our own troops. All three show, therefore, that attempts of this kind may succeed under peculiar circumstances. In the first case success was due to Frederick's carelessness, in the two latter cases to bad discipline and want of watchfulness on the part of the French troops. We do not expect much from the night attack as a regular mode of warfare. It may, however, render good service as a last resource and under exceptional circumstances. . . . . It is therefore surprising that we should continue to promote indolence and want of mobility by banishing night attempts from the field of manœuvre" (see p. 203). We have quoted this passage somewhat at length on account of its peculiar interest at the present time.

Officers and men should be trained to secrecy as to orders received and movements intended. Such secrecy is necessary in war, and the habit thereof should be acquired in peace (p. 58). The corps opposed to one another should be of unequal strength from the first, or this inequality should be produced in the course of the operations by the employment of troops placed at the disposal of the director of the manœuvre (*Verfügungstruppen*) (p. 59).

The director of the manœuvre must fix the moment for commencing operations, and should a surprise be planned by either party, it should not be attempted without informing the director, who should have the opportunity of being present throughout the operations (p. 78). He should endeavour to see as much as possible himself, but, as he cannot be everywhere, his staff and the umpires should keep him informed of what happens beyond the range of his vision. He should be calm and impartial, careful and moderate in his language and in the expression of his opinions. He should not attempt to give advice or instruction during the manœuvre or to correct mistakes, though he should take careful note of everything for subsequent remark. In order to do his duty efficiently, he should be hardy, vigorous, a good horseman, and well mounted. He should at critical moments manage to be near one of the commanders of the contending armies, so as to observe his demeanour and his actions; in case of any change of disposition he should question the commander as to his reasons for the same, but he should guard himself against embarrassing him. All this requires tact, judgment, and experience. The director of a manœuvre "should during the course thereof rather observe than criticize, rather question than answer, and in general rather hold his tongue than talk" (pp. 78–83).

The director may, however, alter the character of a manœuvre by producing a change in the situation through the introduction of actual reinforcements to one or other party (as before noticed), or of *marked* troops or of supposititious troops.

Should he have resort to these means, the change of situation should be produced in a natural and service-like manner. Finally he may find it necessary to put a stop to a manœuvre by his interference and decision, should neither of the two parties consider itself compelled to give way after coming into close contact (pp. 83–88).

What has been said as to the qualities required of the director and of his demeanour applies also in a minor degree to the umpires. They must, above all things, understand the part which they have to play, and that is "*to decide upon the tactical situation when two bodies of troops come into collision, and nothing more.*"

It doing this the umpire must beware of being influenced by personal feeling or by prejudice in favour of any particular corps or arm, or of any particular form of tactics. He must calmly weigh the pros and cons simply from a tactical point of view, and give his decision as quickly as possible. Except when giving his decision, he must refrain from any expression of opinion.

The considerations which should guide him in coming to a decision are—1, the relative strength of the contending bodies; 2, the moral effect which a similar situation might be assumed to exercise upon the combatants in actual warfare (plenty of room here for difference of opinion); 3, the formation of troops on each side; 4, the probable effect of fire on either side; 5, the advantages and disadvantages of the ground to either party. Many umpires only take the first point into consideration, which doubtless simplifies the way to a decision, but is a poor mode of solving the question, as numberless instances of success in action on the part of the numerically weaker body suffice to show.

The umpire should never forget that he is on horseback, and that things may look very different to one in his exalted position from what they do to the actual combatants, and this difference of position must especially be borne in mind in estimating the effect of fire. Colonel v. Boguslawski criticizes a proceeding on the part of umpires which he says is habitual. An attack upon an enemy in position has been pronounced to have failed, but it is decided at the same time that if repeated the attack will succeed. "Upon this the assailant retires, halts and fronts, advances a second time, and carries the position. The decision of the umpire should be just the reverse. If an assailant is forced to retire under the enemy's fire after an unsuccessful attack, he should be considered unable to take the offensive for a long time afterwards. A retrograde movement under the fire of breech-loaders means death." This criticism seems just, always supposing that the assailant receives no considerable reinforcement after the failure of the first attempt, as the critic indeed notices further on. Again, the author finds fault with the habitual action of umpires in the case of a cavalry combat, in that they do not in general act up to the regulations on the subject, regulations which, like most of those emanating from the German War Office, are calculated to give the utmost possible reality to the representation of war (pp. 94–98). When a body of troops is pronounced by an umpire to be *hors de combat* it is, according to the German regulations, ordered to join the reserve of the force to which it belongs. The author does not approve of this course, and prefers their being completely ignored as combatants for as long a period as the umpire may decide (which is, we believe, the custom in our Service). However, do what you will it will be found difficult, if not impossible, to preserve even an approximation to reality in dealing with cases of this sort.

Both the director and umpires must insist on the observance of the regulations made to prevent accident and ill-feeling; at the same time they must take care not to enforce these regulations to the prejudice of warlike reality. This is not sufficiently attended to. For instance, when an attack has been successful you generally hear it said, "Don't press upon the retreating enemy. Give him time to withdraw." This is a mistake. All that the umpires have to do is to insist upon the minimum interval allowed between contending forces being maintained, which is arrived at by obliging the retiring force to continue its retreat without unduly checking the advance of the pursuers.

But the variety of the situations which may arise when two bodies of troops composed of all arms contend together in mimic warfare is very great, and when large masses are operating it must be difficult for even the most highly-trained body of Officers to furnish a sufficiency of really efficient umpires, men whose decisions will be accepted as law by all those competent to judge. The eleventh chapter of

the book before us is one of the most important, and most worthy of study. We have, however meagre may be our notice, devoted to it as much space as we can afford, and must now pass on.

Chapter 12 deals with the "crisis of the manœuvre" and with the director's verdict. The latter will be more or less difficult to arrive at according to the nature of the country, whether open and comparatively level, or enclosed, wooded, and much broken. But even in the former and most favourable case, the observer at peace manœuvres will be under a disadvantage when compared to the looker-on in actual warfare, in that many symptoms of defeat or of victory which are plainly evident to the latter are wanting to the former. Consequently mistaken verdicts are not uncommon, particularly if the director is the sort of man who makes up his mind as to how the affair ought to end, and is incapable of altering his views, or if he be badly served by his staff. In war most fights end by one or the other party evacuating the field of battle. So must it be, as a general rule, at peace manœuvres; but it sometimes happens that neither army gains any decided advantage, and that the two forces continue to hold their original positions at the close of the day. This sort of situation must also be represented in mimic warfare. It will then be for the director to decide whether he will introduce into the plan of campaign a supposition of such a nature as to force one or other party to retire, so as to allow a sufficient interval for regular chains of outposts, or whether he will let the opponents bide where they be, in close proximity to one another and under arms, as they would be in a similar case on actual service, a case too of not infrequent occurrence, and which should therefore be practised, though rarely, for manifest reasons (pp. 107, 108). It seems to be too much the custom in Germany, as it is elsewhere, not to allow an attack to be carried out to the bitter end, but for the director to order the "Halt" to be sounded just as the actual assault is beginning. This is a mistake, for, to use our author's words, "the consequences of defeat should be made manifest—completely and sensibly so to those engaged. . . . It is just the retreat and its accompaniment by the fire of the assailant which first proves that the attack has been well conducted and that the assailant has been judiciously led. The work lacks completeness if not brought to the final test. Troops must be accustomed to push the attack home, bayonet to bayonet. It is only when they stand upon the conquered ground, pouring their fire into the retreating foe, when the cavalry, wheeling round the flanks of the infantry or passing through its intervals, falls upon the fugitives, when the artillery, galloping up into position, unlimbers, then only can the soldier realize the losses which are the consequence of retreat in war, and understand with what stubbornness he must defend himself, with what vigour he must attack his enemy" (p. 111).

Now we will suppose the battle over. The signal "Halt" has been sounded, followed by the "Assembly" and the "Officers' call." The troops repose and refresh themselves. Mounted Officers hasten to the umpire-in-chief, who chooses as commanding a spot as possible. Before judgment is given, the two commanders repeat the special ideas upon which they have been acting, also any instructions received at first or subsequently. All this in a clear and loud voice, so that every one may hear. The director, who has previously received reports from the whole of his staff, and who has also probably taken notes of all that occurred under his personal observation, now, if necessary, asks the commanders to explain some points which may appear to him doubtful, after which he proceeds to give his decision, which should above all be thoroughly impartial and strictly confined to the case in question. He should commence with a short but clear sketch of the operations and of the manner in which they have been carried out, taking care not to enter too much into detail. Whilst doing this, he will mention any cases which have come to his notice personally or by report in which he considers the troops or their leaders to have deserved praise or blame, and will point out the results arising from the acts referred to. Thus carrying on his narrative and critique *pari passu*, he will come to his verdict upon the day's operations. He will do well, after giving it, to ask his hearers whether any one of them disagrees with him as to his statement of any *fact*, and if so to give his own version of it. Should any statement be made in response, the director should duly weigh it and determine what effect, if any, it may have on his decision, which should then be final and without appeal. After giving it, the

director will proceed to determine the military situation resulting from the decision given. This will influence the positions taken up for the night by the contending parties.

It is a common custom in Germany to change the commanders of the contending forces daily, so as to give as many Officers as possible the opportunity of command. The most convenient time for making the change is immediately after the critique, at which time also the general idea for the next day's operations is given out, being either devised there and then in accordance with the situation or prepared beforehand. The former plan seems preferable, as the latter is likely to lead to undue interference with the liberty of action of the commanders.

It is well if possible to quarter the troops at night as they would be under similar circumstances in war. This cannot, however, always be done, owing to the nature of the country and to other considerations, but on no account should the troops of the two armies be intermixed, and the outposts at least should be posted as on service. Next morning the operations recommence on the director's signal.

Colonel v. Boguslawski's remarks upon the manner in which outpost duty is usually performed, especially by the cavalry at field manœuvres, and how it should be performed, are particularly valuable, and we should like to give them *in extenso*, but must deny ourselves that pleasure. The reader will find them in pages 126–131, and will observe that even in Germany the mode of performing this important part of field duty at peace manœuvres leaves much to be desired. Chapter 17 contains much interesting matter, being devoted to the general tactics of offence and defence. The subject is treated in a masterly manner, as was to be expected of the author of the "Development of Tactics from 1793 to the present Time." The remarks upon the use and abuse of flank attacks and turning movements, and those upon practice in constructing, attacking, and defending entrenched positions, are especially worthy of notice (pp. 153–157, 158, 159). Chapter 18 treats of the tactics of the different arms, and points out many absurdities and improbabilities arising from the manner in which troops are handled at peace manœuvres, and which may be remarked more or less in all countries. The author does not appear to agree with the many able Officers of his nation, who expect great results from the action of cavalry in large masses upon the battle-field, which, as is well known, has been much practised of late years in Germany; on the other hand, he thinks that sudden attacks by comparatively small bodies will often be of great value, and that fighting on foot should be paid much more attention to at field manœuvres than is now the case. The Russians may give us all a lesson in this respect some day. In discussing the co-operation of artillery with infantry in attack the author prefers that the former should support the latter by firing from a well-chosen position over the heads of the assailants rather than by accompanying them to close quarters, a course recommended by some tacticians, and which has doubtless been occasionally pursued with effect though with heavy loss to the batteries engaged, even since the introduction of breech-loaders. The author's opinions upon infantry tactics seem to have undergone but little change since he wrote "Tactical Deductions." Many have been the theories started, and many the experiments made, in the intervening period. The most remarkable of these are noticed in Chapter 18 (pp. 179 and 183). The author is convinced of their fallacy, and still advocates the same general principles which are too well known to require further mention. They will be found concisely given at page 182.

But we must now bring to a close our imperfect notice of this valuable little book, which will, we hope, become widely known amongst us, and we will conclude by quoting some of the last sentences in the work, sentences thoroughly applicable to all armies.

"Our field manœuvres may be good, but they are capable of improvement. In order to be a real school of war they should be further developed. To train the leader and test his capacity, to develop the powers of the men, thus steeling the heart and strengthening the character of army and nation—these are the ends which they are intended to fulfil.

"The best test of soundness in an army is the mode in which its field manœuvres are directed and executed."—L. G.

Stratégie. A Study by Colonel Blume, 36th Magdeburg Fusiliers. Berlin, 1882. Mittler and Son. Pp. 261. Size 9″ × 6″ × ⅝″. Weight under 14 oz. Price 5*s*.

Military literature of late years has found an abundant harvest in works on tactics, but a treatise on strategy is of comparatively rare occurrence. The present volume, although somewhat too philosophical for the English taste, is worthy of study; not only on account of the high military repute of its author, but because the method of treating the subject is probably unique. In style, Colonel Blume's diction approaches more to that of Clausewitz than to any other writer we can call to mind.

"Strategy," says Colonel Blume, "is an art and not a science. The masterhand shows itself rather in comprehensive view, penetrative judgment, versatile genius, and, particularly, in force of character. Any attempt to reduce strategy to a definite scientific system would be in contradiction to its nature. Theoretical studies can only aim at training the mind to grasp strategical situations, and to employ aright strategical combinations, and at inculcating general principles."

For the end he has in view, Colonel Blume leaves the beaten track of the majority of his predecessors, who, taking military history as their starting point, endeavour to trace through it the relation between cause and effect. He commences with a study of the forces working in war, and of the sphere of their action. On this, as a basis, and using as guides the experiences and teachings of military history, he draws his deductions.

A great part of the conditions, upon which depends the success in battle of the opposed forces, must be derived from a study of the nature of those forces. Hence, as a first step, Colonel Blume enters into the organization of the forces, the attributes of the different arms, the conditions of their existence, the *rôle* they respectively play in the different circumstances of war. He then proceeds to consider the strategical employment of the forces for overcoming those of the adversary.—F. C. H. C.

Les Télégraphes et les Postes pendant la Guerre de 1870–1. Fragments de Mémoires Historiques. Charpentier. Paris, 1883. Pp. 620. Size 7¼″ × 4½″ × 1½″. Weight 1 lb. 2 oz. Price 3 fr. 50 c.

M. Steenackers was, on the arrival of M. Gambetta at Tours from Paris, invested with the supreme and combined direction of the Telegraph and Post Services in the Provinces. The book, like so many French works, contains for general readers far too much of "No. 1," and the differences of opinion between "No. 1" and the rest of the world, but, nevertheless, it is full of interest. In it we have a most readable account of the means resorted to open and maintain communication between a beleaguered city and the provinces, and of those adopted to disturb the telegraphic communications among the invaders.—L. A. H.

The Elements of Military Administration and Military Law. By Lieutenant-Colonel John Boughey. 8th edition. Webb, York Town, Surrey, 1883. Pp. 221. Size 8¼″ × 5⅜″ × ¾″. Weight under 14 oz. Price 5*s*.

This book, which is used as a text-book at the Royal Military College, was originally compiled from the printed notes which were issued to the students there during the course of lectures on administration and law. It pretends, therefore, to be nothing more still than a note-book giving a general outline of the subjects with which it deals, and is intended to assist Officers in passing for promotion and in the garrison courses, as well as for the use of the gentlemen cadets.

The First Part relates to recruiting, showing the relative advantages and disadvantages of the long and short service, voluntary and compulsory enlistment, &c.; enlistment, describing its condition, the localization and mobilization schemes, and the peace and war organization of the Army; reserves, giving the liabilities and terms of service of Army and Militia Reserves and the auxiliary forces; pay and

allowances, dealing with regimental pay, good conduct pay, and deferred pay; accounts, with examples of ledger, savings' bank ledger. and balance and cash account sheet; rewards for long service, &c., defining the nature of annuities and pensions; supply and transport, at home and abroad, in peace and in war, chiefly as far as the regiment only is concerned. It will be seen from this abstract of its contents that the first part of the book touches upon these questions, which form, or should form, the essential elementary knowledge of a regimental officer; and it is put together in such a manner as to avoid the continual reference to the authorized official books, which would otherwise be necessary.

The Second Part, devoted to military law, is also divided into chapters in the following order: First, introductory; giving the upgrowth of the military code, the difference between military and martial law, and the duties of provost-marshals. Second, on courts-martial; describing the Army Act, and the nature, powers, and jurisdiction of the various courts. Third, on the proceedings before trial; from the commission of the offence to its examination by the commanding Officer (whose powers are given), and the framing of the charge on which the offender may be tried. Chapter four deals with the proceedings of the court itself, and gives the duties and regulations with regard to the different members of the court and the procedure during and after the trial. Chapters five and six touch briefly on the laws of evidence and the composition of Courts of Inquiry and Boards.

Some useful appendices, giving a synopsis of the sections of the Army Act, an example of the form of proceedings of a regimental court-martial, &c., are valuable for reference, and a careful index, absolutely essential where such a mass of facts have to be referred to, renders the subject-matter of the book easily accessible. —C. K.

Die Kriegschiffbauten, 1881–2. Zusammengestellt von J. F. von Kronenfels K.K. Hauptmann D. R., mit 82 in den Text gedruckten Illustrationen. Das schwimmende Flottenmaterial der Seemächte. Erster Ergänzungsband. Hartlebon. Vienna, 1883. Pp. 275. Size $9\frac{1}{4}'' \times 6\frac{1}{4}'' \times \frac{3}{4}''$. Weight under 1 lb. $5\frac{1}{4}$ oz. Price 6*s.* 6*d.*

This book, which is well printed and furnished with many well-executed illustrations, is the first volume of an appendix to the author's larger and former work "Das schwimmende Flottenmaterial der Seemächte," and brings the reader well up to the condition of all Powers possessing a navy. The Appendix in the volume itself deals with the Chinese Navy, even so late as 16th May, 1883.

Kriegsgeschlichtliche Einzelschriften. Herausgegeben von Grossen Generalstabe. Abtheilung für Kriegsgeschichte. Heft II. Mittler. Berlin, 1883. Pp. 129. Size $9'' \times 6'' \times \frac{1}{3}''$. Weight under 10 oz. Price 2*s.* 6*d.*

Heft I of this publication was noticed in No. CXX of the Journal, and a translation of the incident of Von Boltenstern's expedition in the Loir Valley appeared in No. CXXI. The contents of the present number consist of two articles. The first is a series of extracts from the papers and reports of H.R.H. Prince Augustus of Prussia, relating chiefly to the events of the disastrous campaigns of 1806, and to those of 1813–14–15, the war of liberation, and the two invasions of France. Of special interest is the narrative of the Prince's retreat from the field of Auerstadt, until his final surrender with the remnant of the battalion which he then commanded in the neighbourhood of the town of Prenzlau, north-east of Berlin. Although it can hardly be said that he throws any new light on the circumstances of that disastrous period, those who read between the lines will still find interesting indications of the spirit which then pervaded the higher ranks of the Prussian Army, and which, combined with other influences, led to its so rapid and complete overthrow.

The Prince's remarks on the battle which took place near Bautzen, in May, 1813, may well be compared with other accounts. By this time the Prince was in active command of an infantry brigade, and had further, in August, 1808, been nominated

to the command of the Prussian artillery, and in this capacity his observations on the action of the existing artillery, more especially on the part taken in the battle of Bautzen by that of Blücher's Corps, are worthy of attention, however opposed the principles which he advocates may be to those prevailing in the present day. During the campaign of 1815 the Prince was entrusted with the reduction of the fortresses of northern France, and the number closes with his recital of the main incidents of these operations and with his remarks on siege warfare.

The second article narrates a successful attempt on the part of a French detachment to cut the railway which formed the main line of the German communications in 1870–71 in the neighbourhood of Toul by blowing up the bridge at Fontenoy on the Moselle.

The number worthily supports the object with which the publication was commenced, and may be recommended to the attention of tactical students.—B. W.

Conduct of a Contact Squadron. By Captain R. de Biensan, 3rd (French) Cuirassiers. Translated from the French by Major C. W. Bowdler Bell, 8th Hussars. Mitchell, London, and Sheldrake, Aldershot. 1883. Pp. 121. Size $8\frac{1}{4}'' \times 5\frac{1}{2}'' \times \frac{1}{2}''$. Weight under 10 oz. Price 5*s*.

The original of this work was noticed in No. CXIII of the Journal, and Major Bell, 8th Hussars, has rendered a real service to the branch to which he belongs by his translation of the above-mentioned *brochure*, by Captain de Biensan, 3rd (French) Cuirassiers.

Taking for model General Verdy's "Studies," the author has portrayed the four days' movements of a squadron despatched, on duties of reconnaissance, from one of the cavalry divisions covering an Eastern Army, advancing towards Chalons and Paris. In fact, he has epitomized one of the measures by which the 3rd Prussian Army, in August, 1870, ascertained the abandonment of the Camp of Chalons, and the move of MacMahon's forces towards Metz. The detail is very complete and the instruction ample, more especially as Major Bell has not failed to add short notes where further elucidation appeared to be necessary. We are glad to see that the author lays great stress on the necessity for a knowledge of map-reading by the non-commissioned officers of cavalry. How much more so for the Officers, and how many instances does he give when the power of rapid sketching is absolutely required from them when giving instructions to leaders of patrols and reconnoitring parties.

In the remarks under No. V of "Conclusions," we fully concur. There is but one organization for cavalry—the squadron, and the sooner we adopt it in peace, as must be the case in war, the better for the efficiency of our cavalry force. We reproduce the very words of the author:—"The squadron is a very complete unit in the hand of its leader. Its tactical and administrative organization, its numbers, equally suitable for overcoming slight resistance and for avoiding serious attacks, give it great independence."

The thanks of all who care for tactical study are due to Major Bell.—B. W.

Third Report on the Education of Officers. By the Director-General of Military Education. London, 1883. Pp. 159. Size $9\frac{1}{2}'' \times 6\frac{1}{4}'' \times \frac{1}{2}''$. Weight under 10 oz. Price 10*d*.

This report is far more interesting than are usually works of this character, as at the low price of a penny an ounce is furnished a report on the condition and progress of the education of the Army during the seven years 1876-82. Criticism on the policy or acts of a military department of the Army would be out of place here, so we merely commend the report to the notice of the members of the Institution, to whom it will afford many topics for thought and discussion.—L. A. H.

What to Observe and How to Report it. By Colonel Lonsdale Hale, ret. R.E., Pamph. Pp. 46. Price 6*d.* Sixth edition.

This pamphlet has been accepted by the authorities as an official publication, and into the text and plates have been introduced such alterations as were necessary to bring its contents into thorough conformity with the recently issued "Text-Book of Military Topography." The alterations have not in any important way affected the object the pamphlet was intended by its writer to fulfil, namely, to act as stepping-stones to further knowledge and to supply milk for those who could not digest meat. To prevent misunderstanding, it is desirable to state that the writer of the pamphlet has no pecuniary interest of any kind in its circulation.—L. A. H.

Notes on the Government Surveys of the Principal Countries. With the Civil and Military Divisions and Area of each Country, Measures of Length and Surface, Lists of Government Maps, Conventional Signs and Abbreviations employed, and useful Tables for Map-reading; to which is added a List of Colonial and Extra-Colonial Possessions and a List of Map Agents. Prepared at the Intelligence Branch, Quartermaster-General's Department, War Office, 1882. London. Printed under the Superintendence of H.M. Stationery Office. Pp. 166. Size $9\frac{1}{2}'' \times 6\frac{1}{2}'' \times \frac{3}{4}''$. Weight 1 lb. 2 oz. Price 6*s.*

It is very much to be regretted that the Government publishers have not the same incentives to push the sale of their publications as have private firms; for if they had, the fact of the existence of this book would then be generally known. Many of the works originating in the Intelligence Branch are necessarily of such a character that they are of interest and of use but to a few persons, but these "Notes" are invaluable to every one who may ever have to look at a foreign map or have to deal with a foreign measure. The choice of, or rather the arrangement of, the title will, it is to be feared, mislead many who, taking no interest in Government surveys, will pass by without notice a work which incidentally gives a vast mass of valuable information, of practical use to a large number of both Officers and civilians. The labour expended on collecting and preparing these "Notes" for publication must have been very great, and we are sorry that the compiler, being not officially recognized on the title-page, cannot therefore receive the credit for his work and the thanks of those who will profit by his industry. The list of colonial and extra-colonial possessions is most useful, and that of map agents includes those abroad as well as those at home.—L. A. H.

A System of Field Training. By Major C. K. Brooke, the East Yorkshire Regiment. London: Kegan Paul, Trench, and Co. 1883. Pp. 99. Size $7'' \times 5'' \times \frac{1}{2}''$. Weight 6 oz. Price 2*s.*

This little book was written, the author tells us, before the orders were issued dealing with the musketry training of the Army and instituting a six weeks' course of instruction for each company of infantry. Major Brooke deals fully with the field training of the arm to which he belongs—the infantry, alluding more briefly to the requirements of the other arms, "for," he writes, "it is impossible for any Officer not belonging to the arm in question to lay down in detail a course of instruction for it. To estimate truly all the wants of any one branch of the Service, it is necessary to have lived in it for some years, to have worked in it, and, if possible, to have served with it in the field. Points requiring amendment, and additions which may have become necessary, can be suggested by a careful outside observer; but a comprehensive scheme for its field training can only be worked out by one belonging to it." The foregoing statement, put forward at a time when it behoves every one interested in the better training of soldiers for field work to contribute each his mite to the elucidation of the subject, cannot be passed by without protest. It appears to us that a portion of that statement requires inversion, for the working out of a comprehensive scheme of field training for any one arm lies

perfectly within the capacity of those who know the situations on active service and on the battle-field in which that arm is found; whereas it is the inside, not the outside, observer who is the man fitted to suggest points requiring amendment and additions which may have become necessary. Major Brooke has, however, given us an excellent little work and one thoroughly of a suggestive character. He has, we hope, started rolling a literary ball which will, we trust, be kept in movement by many followers. Major Brooke declines to draw up a synopsis of a course of field instruction, because such a course would involve entering into too much detail, and further on (p. 7) he expresses his opinion that the Officer in teaching his men should not be hampered by a minute series of instructions as to how the instruction is to be imparted; but it must be remembered that to nearly all the Officers of our Army field teaching is something absolutely new, and whilst it would be contrary to the principles of sound education unnecessarily to tie the hands of an instructor, yet it is rather hard on novices in this art not to supply them at the outset of their career with such leading-strings as will show them how to walk, and so enable them eventually to dispense with their support. The list of works consulted by the author and given in Appendix G will be found very useful by those who wish to learn more of the details of the field training of soldiers.—L. A. H.

Field Artillery, its Equipment, Organization, and Tactics. By Major Sisson C. Pratt, R.A., Professor of Military History at the Royal Military Academy. Being the third volume of Military Handbooks for Officers and Non-commissioned Officers. Edited by Colonel C. B. Brackenbury, R.A., late Superintending Officer of Garrison Instruction. London: Kegan Paul, Trench, and Co. 1883. Pp. 291. Size $6\frac{3}{4}'' \times 4\frac{1}{8}'' \times 1''$. Weight under 14 oz. Price 6*s*.

This handbook will be found to be of great value to Officers of all arms of the Service. It is full of information; it is well written, and with the arrangement of subjects little fault can be found. Whether the same work can be a handbook for non-commissioned officers as well as for Officers may, however, be doubted. Of [the contents of the books six chapters and a half are devoted to Technical Artillery, and nine chapters and a half to the Tactics of Artillery.

Whilst recommending to Officers this book for perusal, as we do most strongly, we feel bound to ask them to preserve, whilst reading the chapters on the tactics of artillery, complete independence of judgment when studying the opinions, statements, and prophecies put forward by the author.

Not even the powerful combination of the well-known editor of the handbook and of a "master of modern tactics" (Preface, p. v) should serve as an excuse to any Officer (with non-commissioned officers we are not here concerned) to accept without due consideration the tactics enumerated in this work. For practical purposes some rules and principles of action must be adopted, but tentatively only, and he will be best fitted to meet the requirements of the next campaign who is prepared at a moment's notice to modify, in order to meet hitherto unexperienced conditions, the rules and principles of the present. We heartily desire that this book may be read by all Officers, but we must be forgiven if we emphasize our foregoing remarks by calling their attention first to the bold prophecy at pp. 91–2, to the effect that "the effective range of both guns and infantry can never materially alter from the present time" to the assertion that "long-range," is a "hitherto untried species of warfare," to the extract from Liebert, in which it seems to be ignored by both quoter and quoted that it was in one of the largest armies, viz., the German, that long-range fire was first reduced to a disciplined system, and lastly to the summary treatment of a village attacked by artillery, as described at p. 245. As regards the last point it would have been more satisfactory if the author had given even one instance in which artillery have from a distance detected the second line of defence in a village, or in which good troops, *properly* posted in a village, have in modern warfare been in any way affected by the artillery fire brought to bear upon it. If, as at St. Privat, nearly 300 guns have to come into action on a village before producing a decisive moral effect on the garrison, the example certainly does not tell in favour of the power of the artillery.

As a contribution to the existing literature on tactics, and as a most valuable contribution, is this work to be regarded, but not the settlement of a most difficult question.—L. A. H.

Military Transport by Indian Railways. By David Ross, C.I.E., F.R.G.S., with map, drawings, and diagrams. Lahore, 1883. Can be obtained from Chapman and Hall, London. Pp. 109. Size 9″ × 5½″ × ¾″. Weight under 1 lb. 1½ oz. Price 8*s.*

The author superintended, during the late war in Afghanistan, in 1878-81, the arrangements for the despatch of troops of all arms, as well as that of military stores, by the Sindh, Punjab, and Delhi Railway; and the results of his experience during that period were set forth by him in a lecture, delivered at the United Service Institution of India at Simla. That lecture is now issued in a condensed form; various reports on the question of military transport by Indian railways, which have been submitted from time to time, have also been revised and embodied, and the whole, comprising all the available information on this most important and interesting subject, is now published in this book, dedicated by permission to the Commander-in-Chief in India. The extent to which railway transport was used in that campaign may be estimated from the fact that the gross military traffic booked under Government warrants during the Afghan War was, so the author tells us—

538,364 troops and followers.
114,156 horses, ponies, and mules.
15,477 bullocks.
8,654 camels.
479 guns, artillery and engineers' carriages.
148,889 tons of commissariat, ordnance, and military stores.
93,099 tons of material for the frontier railways.

Requiring an estimated number of 2,023 trains, 785 of which were special troop, live stock, and material trains.

The weight of stores despatched only represents the quantity booked under Government warrants, and as the greater portion of commissariat supplies were sent by traders, these figures only show a small proportion of what was actually forwarded by rail.

On the other hand, the number of troops and followers conveyed seems very high, but this arises from each separate despatch of troops being reckoned as a fresh departure. Thus a number of regiments were concentrated at various places in the first instance, and remained there for a few weeks before proceeding to the front; these troops, of course, are reckoned twice, and often three times. Each despatch involved nearly the same amount of work, with the exception of haulage, to the railway authorities, as if the regiments had gone at first right through to their destination, that is, so far as collecting stock, embarking and disembarking, and arranging time tables were concerned. For some time there were about sixty trains entering and leaving the Lahore station daily, which will give an idea of the heavy work that had to be conducted, and this on single lines of railway.

Mr. Ross's book is full of valuable information, and is a welcome contribution to the literature which deals with one of the most difficult branches of military administration.—L. A. H.

The Development of Armour for Naval Use. By Lieutenant E. W. Very, U.S.N. Trübner and Co., Ludgate Hill, 1883. Pp. 243. Size 9½″ × 6¼″ × ¾″. Weight 1 lb. 3½ oz. Price 7*s.* 6*d.*

The book appears to be a reprint of a paper in the "Proceedings of the United States Naval Institute," vol. ix, 1883, which are published quarterly by the Institute.

In the first chapter he discusses in a practical way the principles which should govern artillery attack of armour—mainly dealing with the question of relative advantages of "racking" and "punching"—and without attempting to look at them from a scientific point of view.

In the second chapter he deals with the introduction and development of iron armour for ships during the "smooth-bore" period in Europe, and he properly gives France the credit of turning out the first ironclad squadron—that which attacked Kinburn in 1855—though he proves that his own countryman, Robert Stevens, gave the first practical impulse to the adoption of armoured ships in Europe by being first in the field with the designs of a steam armoured war-vessel. For some unaccountable reason the United States did not at that time take up the idea.

In a similar way he argues that though Ericsson and Cowper Coles were close together in their ideas about low freeboard vessels with armoured turrets, yet the priority of design of such ships belongs to Ericsson because he *floated* the first vessel with a *revolving* turret though she was *not a seagoing ship*. Cowper Coles he admits was first in laying down the keel of a ship with a revolving turret, and certainly launched the first *seagoing* turreted ironclad.

On the other hand Lieutenant Very says that before Ericsson had submitted his design of a monitor to the Naval Commission, Captain Cowper Coles had demonstrated in public the advantages of the turret mounted on low freeboard ironclad hulls, and he takes pains to correct a very general impression amongst Americans that the introduction of the ironclad was principally due to the steps taken by the United States in creating a fleet at the outbreak of the Civil War. He points out how that in spite of the valuable experience gained in the actions between monitors and forts in that war, and in experiments abroad, the improvement of armour was neglected in his country, and what was even worse, the introduction of rifled guns was withheld long after the immense inferiority of smooth-bores for the attack of armour had been clearly demonstrated.

In another part he reads us a lesson on our unaccountable slowness to adopt breech-loading and to improve the manufacture of our gunpowder by which in recent years England has been allowed to fall behind other Powers in respect of the attack of armour, when we might easily, and ought to, have kept a clear lead.

Lieutenant Very has carefully studied the results gained from the armour-plate experiments at Shoeburyness, and in Europe generally, and follows with intelligence the successive steps taken with new kinds of armour, such as steel, compound (steel and iron) plates, and massive chilled cast-iron armour.

In a few cases the author has fallen into error in dealing with the results of European trials; for instance, when at page 449 he infers the superiority of the Prussian method of artillery development over that of Woolwich from the result of a shot fired in 1879 at Meppen; for the target used on that occasion was made of such inferior material, and was so badly put together, that it was altogether unreliable for the purposes of the conclusions attempted to be drawn from the trial. He also gives some account of the processes of manufacture by which these materials have been produced in Europe.

In the concluding chapter of his paper Lieutenant Very also gives a brief account of the various formulæ which have been used in calculating the resisting power of armour. These apply only to wrought-iron armour, as it has not yet been found practically possible to reduce to law the action of projectiles on hard steel and cast-iron armour.

To those who may wish to take up afresh the subject of armour-plating, especially that for naval purposes, Lieutenant Very's paper will prove an exceedingly useful and instructive guide, while for those who may be already well acquainted with the subject and professionally interested in it, the paper will be found to contain much that will render it a convenient work of reference.—T. I.

Hints to Courts-Martial, Confirming and Commanding Officers upon many matters usually coming under their notice. By J. C. O'Dowd, of the Middle Temple, Barrister-at-Law. Deputy-Judge-Advocate-General of the Forces. Second Edition. London: Clowes and Son. 1882. Pp. 167. Size 7″ × 5 × ″½″. Weight under 10 oz. Price 4*s.* 6*d.*

The official position held by the author of this work places the book on a platform distinct from those occupied by amateur lawyers, although the author expressly states that it is altogether unofficial. Mr. O'Dowd says in his Preface to the First Edition: "For several years before the passing of the Army Act, 1881, Military Law was in a transition state. Changes were either imminent or in process of embodiment. That fact prevented any previous attempt on my part to fulfil the main object of this work, viz., the publication in a brief, popular, and easily intelligible shape, of something in the nature of a digest of authoritative opinions upon the various questions that commonly come to be dealt with by courts-martial. These opinions have the character and weight of judicial decisions. But unlike the judgments of the ordinary tribunals, which interpret, and in a certain sense make the law, they are communicated to nobody but the persons connected with the particular case dealt with at the moment. Whatever value they may possess in the way of guidance and precedent is thus to a great extent lost. In the following pages I have summarised and applied generally many of these rulings, accompanied with remarks applicable to the administration of Military Law. The work is not intended to be an exact or exhaustive treatise. . . . I hope that, when read together with the penal sections of the Army Act, 1881, and the new Rules of Procedure, it will be found to meet in a practical way probably nineteen out of twenty of the points arising in ordinary course before a court-martial." The second edition is the original work generally revised with some slight additions.—L. A. H.

Military Law; its Procedure and Practice. By Major Sisson C. Pratt, R.A., Professor of Military History at the Royal Military Academy, being the Fifth Volume of Military Handbooks for Officers and Non-Commissioned Officers, edited by Colonel C. B. Brackenbury, R.A., late Superintending Officer of Garrison Instruction. London: Kegan Paul, Trench. 1883. Pp. 225. Size 6¾ × 4¾ × ½. Weight under 10 oz. Price 4*s.* 6*d.*

Colonel Brackenbury in his Preface states that this book has been compiled by an acknowledged authority on the subject, in order to aid Officers and non-commissioned officers in overcoming the many difficulties which attend the study of the legal part of their profession; it must be looked upon as an aid to, and not as a substitute for, the ordinary legal military code; the method of arrangement is somewhat novel, and will, it is hoped, be found to have the merits of simplicity and ease of reference. The author himself in a note informs us that after a considerable portion of the book was written the "Official Manual of Military Law" was provisionally issued, and he has had the advantage of deriving from it the most recent authoritative decisions on disputed points. Colonel Parsons, Deputy-Judge-Advocate, has also assisted in revising the proof sheets of this work.

This book, coming forward under the ægis of the authorities above-named, stands therefore a little aside from the ruck of publications on Military Law with which we are now deluged, but we understand that Colonel Parsons is in no way responsible for the conclusions or statements of the author, although he has aided him on certain points. It is, however, enough to make the late Sir Charles Napier turn in his grave to find non-commissioned officers aided in their "study of the legal part of their profession."—L. A. H.